Service Source

PowerBook 500 Series

PowerBook 520, PowerBook 520c,
PowerBook 540, PowerBook 540c

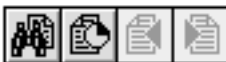# Basic Navigation Within Service Source

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Basics

PowerBook 500 Series
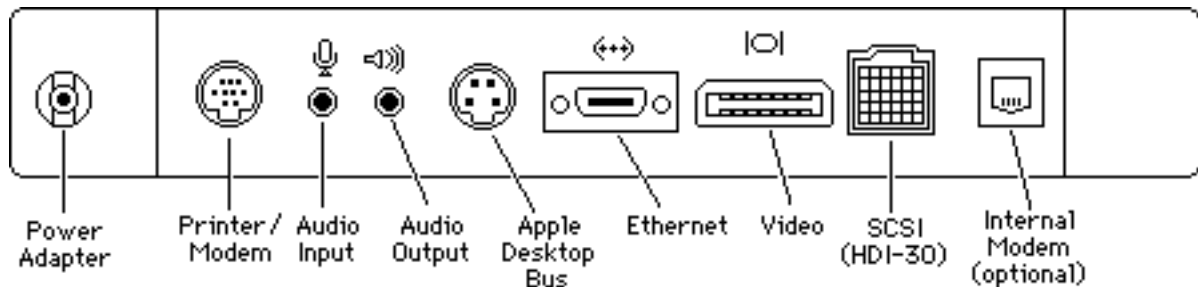
Figure: PowerBook 520, 520c, 540, and 540c

General Information

The PowerBook 500 Series introduces a number of technology and design innovations to the PowerBook family of computers. The series features a built-in trackpad, intelligent batteries, two battery bays, an optional PCMCIA expansion module, and four displays: monochrome and color FSTN and active-matrix displays.

Rear Panel

The illustration below shows the location of ports and connectors on the rear panel of the PowerBook 500 Series.

Power Adapter | Printer/Modem | Audio Input | Audio Output | Apple Desktop Bus | Ethernet | Video | SCSI (HDI-30) | Internal Modem (optional)

PB Screw Matrix

Nine different types of screws are used in the PowerBook 500 Series. All are Torx screws and require either a T-8 or T-6 Torx screwdriver.
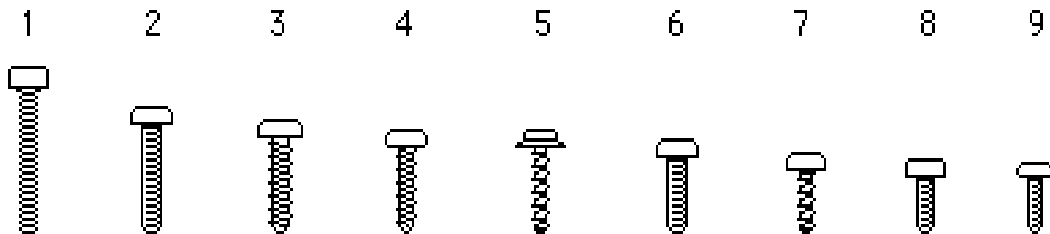
Note: The legend for the screws follows on the next page.

Legend for PowerBook 500 Series Screws

1   Feet

2   Hard drive, keyboard, bottom case (middle front),
    display assembly, floppy drive, daughterboard EMI
    shield (top edge), inside edge of top case, right side panel

3   Display bezel, display, clutch, DAA

4   Trackpad cable and actuator, daughterboard EMI shield
    (sides), motherboard standoff

5   Rear panel

6   Hard drive bracket

7   Inverter board, interconnect board

8   Bottom case (front corners), left side panel

9   Floppy drive bracket

PB Cable Matrix

For a matrix of cables that work with specific models of the PowerBook family of computers, refer to the PowerBook Cable Matrix in the Hardware/Compatibility Charts tab.

PCMCIA Module Handling

The PCMCIA (Personal Computer Memory Card International Association) expansion module is an option for the PowerBook 500 Series. The module inserts into the computer's second (left) battery bay and has two slots that accept a variety of third-party PCMCIA cards.

There are three types of PCMCIA cards: Type I (3 mm), Type II (5 mm), and Type III (10 mm). Type I and Type II cards fit in either the upper or lower slot of the expansion module. Type III cards fit in the lower slot and take up both slots.

The following are guidelines for properly handling the PCMCIA expansion module:

• Do not insert or remove the PCMCIA expansion module while the computer is on or in Sleep mode. if you do, the

computer will shut down and all RAM contents will be lost.

- Eject the PCMCIA module using the lever at the front of the module; eject a PCMCIA card using the PCMCIA Eject control panel or the PCMCIA Quick Eject module in the computer's Control Strip.
- Keep the protective cap that comes with the module and place it back on the module when it is not in use.
- Do not open the module or insert anything other than a PCMCIA card into the card slots.
- Keep the module in a safe place, away from small objects that might fall into it.
- Before ejecting a PCMCIA card, make sure nothing is blocking the card's slot. To immediately reinsert the card, pull it out an inch more and then push it back in.
- Use only cards that are compatible with the PCMCIA expansion module. Refer to the compatibility information that came with the card.

Battery Handling

The PowerBook 500 Series computers include one or two nickel-metal-hydride (NiMH) batteries. Each battery provides power for up to 3.5 hours of work time, depending on the battery conservation features employed. A smart processor included in each battery pack indicates the battery's charge status.

⚠ Warning: NiMH batteries contain toxic materials. Send undamaged, dead batteries to Apple for recycling—do not discard dead batteries with other waste. If the battery is damaged, do not return it to Apple. Dispose of damaged batteries according to local ordinances. Review battery-handling and disposal instructions in Bulletins/Safety.

The following are guidelines for properly handling the PowerBook 500 Series battery:

- Handle the battery carefully. Do not drop, puncture, disassemble, mutilate, or incinerate it.
- Do not short-circuit the battery terminals.
- Do not leave a battery in the computer for longer than a week without plugging in the power adapter.
- Do not leave the battery in hot locations (such as the trunk of a car).
- Keep the battery in a cool, dark place; do not store it for longer than 6 months without recharging.
- If you are using one battery: Completely discharge and then recharge the battery once every 90 days.
- If you are using two batteries: Swap the left and right batteries every month.
- Fully charge a replacement battery before using it; Apple ships batteries in a partially charged state.

Battery Verification
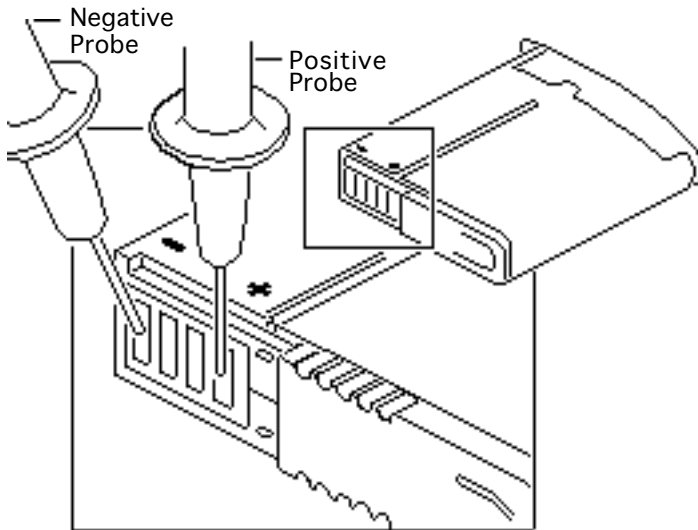
The Control Strip on the PowerBook 500 Series desktop shows the battery charge and the rate at which the battery is being used. Use a voltmeter to measure the actual battery charge:

- Set the voltmeter to the 10 volts DC scale.
- Hold the positive probe of the voltmeter to the positive battery terminal and the negative probe to the negative terminal.
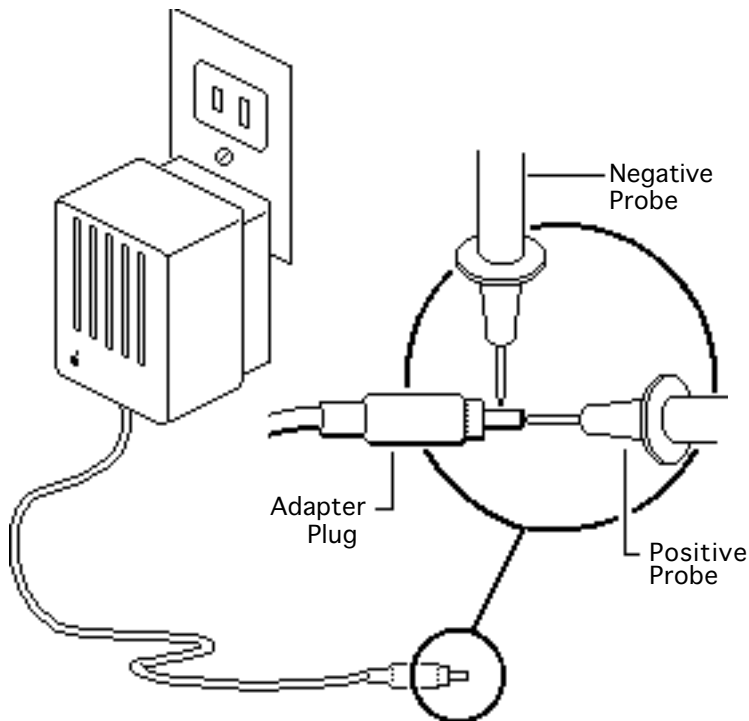
Negative Probe

Positive Probe

- A fully charged battery measures approximately 10.8 volts; a fully discharged battery measures 7.8 volts.

Note: If a battery is stored outside the computer for extended periods, its voltage may drop to 5.0.

Adapter Verification

To verify the charge of the AC adapter,

- Plug in the AC adapter to a wall socket.
- Set a voltmeter to the 10 volts DC scale.
- Touch the positive volt-meter probe to the inside of the adapter plug and touch the negative volt-meter probe to the outside of the plug. If the reading is not 16 volts, replace the adapter.

Specifications

PowerBook 500 Series

Processor

PB 520/520c	Motorola 68LC040 microprocessor 50/25 MHz
PB 540/540c	Motorola 68LC040 microprocessor 66/33 MHz
Addressing	32-bit internal registers 32-bit address bus 32-bit data bus

Memory

RAM   4 MB RAM installed on the daughterboard
                       Expandable to 12 MB with 8 MB Apple RAM expansion card
                       Expandable to 36 MB with third-party RAM expansion card

ROM   2 MB

PRAM   256 bytes of parameter memory

VRAM   512K of static video display memory

Clock/Calendar   CMOS custom chip with long-life lithium battery

Disk Storage

Floppy Drive   15 mm high, internal, 1.4 MB Apple SuperDrive

Hard Drive   2.5 in. hard drives (160 MB, 240 MB, and 320 MB capacities)

I/O Interfaces

SCSI
HDI-30 SCSI port with 1.5 MB/sec. transfer rate
Supports up to six external SCSI devices
Connect SCSI device to computer with HDI-30 SCSI system cable.

Apple Desktop Bus
Apple Desktop Bus (ADB) port
200 mA maximum current draw for all ADB devices

Serial
RS-422 serial port; mini DIN-8 connector

Sound
Stereo sound-in port
Stereo sound-out headphone jack; standard 3.5 mm stereo
   miniplugs

Video   Micro DV-14 video-out port; 8 bit, 256 color video output
                              Supports most Macintosh, VGA, and SVGA monitors

Ethernet   High-speed Ethernet port; Apple AUI connector

Processor-Direct Slot   90-pin processor-direct slot (PDS) for PDS devices or optional
                              Personal Computer Memory Card International Association
                              (PCMCIA) adapter/PCMCIA expansion module (allows use of
                              two Type II or one Type III PCMCIA-type card)

Power Adapter   Power adapter port

Modem   Slot for optional internal modem

Security   Slot for third-party security equipment

I/O Devices

Keyboard   Built-in keyboard with 12 function keys
                       76 keys domestic, 77 keys ISO
                       Two-level tilt adjustment

Trackpad   Solid-state trackpad

Microphone   Electret, omnidirectional
                       Output voltage of 4 mV, peak to peak

Sound and Video

Sound Generator	Apple sound chip provides 16-bit sound capable of driving stereo headphones or other stereo equipment through the sound jack
	Built-in stereo speakers
PB 520 Video Display	9.5-in. (24 cm) diagonal screen
	Backlit, FSTN grayscale display (16 levels); 640 x 480 pixels
PB 520c Video Display	9.5-in. (24 cm) diagonal screen
	Backlit, dual-scan color display (256 levels); 640 x 480 pixels
PB 540 Video Display	9.5-in. (24 cm) diagonal screen
	Backlit, active-matrix grayscale display (16 levels); 640 x 480

PB 540c Video Display
9.5-in. (24 cm) diagonal screen

Backlit, active-matrix color display; 640 x 400 pixels at thousands of colors; 640 x 480 pixels at 256 colors

Electrical

Main Battery   One or two nickel-metal-hydride (NiMH) batteries
Up to 3.5 hours of usage per battery before recharging
Recharge time: 2 hours in shut down or sleep mode, 4 hours while
computer is running

Power Adapter   110–240 VAC line voltage
40 W, 50–60 Hz

Physical

Dimensions

Height	2.25 in. (5.7 cm)
Width	11.5 in. (29.2 cm)
Depth	9.65 in. (24.5 cm)

Weight

PB 520/520c	6.4 lb. (2.9 kg) with one battery
PB 540/540c	7.3 lb. (3.3 kg) with two batteries

Environmental

Operating Temperature   50–104°F (10–40°C)

Storage Temperature   -13 to 140°F (-25 to 60°C)

Relative Humidity   20–80% noncondensing

Operating Altitude   0–10,000 ft. (0–3048 m)

Storage Altitude   0–15,000 ft. (0–4572 m)

Other

Internal Modem   Sends and receives data at 19.2 bps; sends and receives faxes at
                            14.4 bps

SCSI Adapter   Enables connection between PowerBook computer and desktop
                            Macintosh (PowerBook appears as a hard drive on the desktop)

PCMCIA Module   Enables use of two Type I or II PCMCIA cards or one Type III card

Troubleshooting

PowerBook 500 Series

General

The Symptom Charts included in this chapter will help you diagnose specific symptoms related to your product. Because cures are listed on the charts in the order of most likely solution, try the first cure first. Verify whether or not the product continues to exhibit the symptom. If the symptom persists, try the next cure. (Note: If you have replaced a module, reinstall the original module before you proceed to the next cure.)

If you are not sure what the problem is, or if the Symptom Charts do not resolve the problem, refer to the Flowchart for the product family.

For additional assistance, contact Apple Technical Support.

Power Manager Reset

Reset the power manager if

- The battery and power adapter are proven good, but the computer will not power on.
- The computer will not reset after a system crash.

To reset the power manager in the PowerBook 500 Series,

- Remove the AC adapter and the battery.
- Let the unit sit without power hooked up for 3–5 minutes.
- Simultaneously hold down the Control, Command, Option, and Power On keys for 5–10 seconds.
- Reinstall the battery and, if necessary, reconnect the AC adapter.
- Turn on the computer.

AC Adapter Voltage Test

To test the AC adapter voltage,

- Use narrow test probes for the leads on your voltmeter
- Make all measurements with the negative or common lead touching the outer shield of the connector (ground)
- Use the following table to identify the connector pin number, signal name, and DC voltage present

Connector Pin	Signal	DC Voltage
1	VBATT	16.4–16.6V
2	VMAIN	16.4–16.6V
3	GND	0V
4	GND Sense	0V

Symptom Charts

Startup

RAM failure occurs
(eight-tone error
chord sounds after
startup chord)

1 Reseat RAM expansion card and check connection.
2 Replace RAM expansion card.
3 Replace daughterboard.
4 Replace motherboard.

Hardware failure
occurs (four-tone
error chord sounds
after startup chord)

1 Disconnect hard drive cable and restart computer. If startup
  sequence is normal, reconnect cable and retest.
2 Replace hard drive.
3 Disconnect floppy drive cable and restart computer. If
  startup sequence is normal, reconnect cable and retest.
4 Replace floppy drive.
5 Replace motherboard.

Power

Screen is blank;
computer doesn't
respond

1 Restart computer.
2 Connect power adapter and restart computer in 3–4 minutes.
3 Try known-good, charged main battery.
4 Check all interconnect board, daughterboard, and
   motherboard connections.
5 Reset the power manager.
6 Replace keyboard.
7 Replace interconnect board.
8 Replace daughterboard.
9 Replace motherboard.

Power (Continued)

After you remove
main battery, some
Control Panel
settings are different

1   Check cables.
2   Replace backup battery.
3   Replace interconnect board.
4   Replace daughterboard.
5   Replace motherboard.

Power adapter is
plugged in, but
Control Strip doesn't
indicate adapter is
connected

1   Verify that power adapter is connected correctly.
2   Try known-good, charged main battery.
3   Try known-good power adapter.
4   Replace motherboard.

Power (Continued)

Low-power warning appears

1 Recharge battery or attach power adapter.
2 Verify that peripherals are low-power.
3 Reduce use of floppy or hard drive, modem, sound, backlight, or other power-consuming devices, or connect power adapter.
4 Try known-good, charged main battery.
5 Try known-good power adapter.
6 Replace motherboard.

Computer runs when plugged into wall outlet but not on battery power; battery voltage is within tolerance

1 Reseat battery to make sure battery is mating with contacts on motherboard.
2 Replace motherboard.
3 Return computer to Apple.

Power (Continued)

Computer won't
power up

1 Restart computer.
2 Connect power adapter and restart computer in 3–4 minutes.
3 Try known-good power adapter. Verify power adapter tip is
   not chipped or cracked.
4 Try known-good, charged main battery.
5 Replace fuse on motherboard.
6 Replace motherboard.
7 Return computer to Apple.

Video

Pixel never comes on
or is always on

1 PowerBook 540c, color active matrix display only: Replace
   display (CPRC/ international repairers only) or return
   computer to Apple.

2 PowerBook 540: If there are more than five voids (pixels
   that are always white), or two or more voids within one inch
   of each other, replace display (CPRC/ international
   repairers only) or return computer to Apple.

3 PowerBooks 520 and 520c: Replace display.

Partial or full row of
pixels is always on or
never comes on

1 Check cables.

2 Replace interconnect board.

3 Replace motherboard.

4 Replace display.

Video **(Continued)**

Display is very light
or totally white

1 Adjust screen contrast and brightness settings.
2 Verify cable, inverter board, interconnect board,
   daughterboard, and motherboard connections.
3 Replace inverter board.
4 Replace interconnect board.
5 Replace interconnect-to-display cable.
6 Replace display.
7 Replace daughterboard.
8 Replace motherboard.

Display stopped
working or dimmed
but is fine now

1 PowerBook 520/520c: If temperature is under 5° C or over
   40° C, this reaction is normal.
2 Let screen warm up for 30 minutes.

Video (Continued)

Backlight doesn't operate

1 Verify that backlight cable connection is secure.
2 Check cable, inverter board, interconnect board, daughterboard, and motherboard connections.
3 Verify that cables are not pinched or severed.
4 Replace inverter board.
5 Replace interconnect-to-inverter cable.
6 Replace interconnect board.
7 Replace interconnect-to-display cable.
8 Replace display.
9 Replace daughterboard.
10 Replace motherboard.

Thin white line is always on at middle of screen

PowerBook 520/520c: Thin white line is normal.

Video **(Continued)**

No display, but
computer appears to
operate correctly

1 Press any key to wake computer from system sleep.
2 Adjust screen contrast and brightness settings.
3 Verify cable, inverter board, trackpad, keyboard, inter-
   connect board, daughterboard, and motherboard connections.
4 Connect power adapter.
5 Replace inverter board.
6 Replace interconnect board.
7 Replace interconnect-to-display cable.
8 Replace display.
9 Reseat daughterboard.
10 Replace daughterboard.
11 Replace motherboard.

Floppy Drive

Audio and video
present, but internal
floppy drive does not
operate

1. Try known-good floppy disk.
2. Check floppy drive cable connection.
3. Replace floppy drive cable.
4. Replace floppy drive.
5. Replace motherboard.

Disk ejects while
booting; display
shows Mac icon with
blinking X

1. Try known-good system disk.
2. Verify that trackpad and trackpad button are working.
3. Verify that keyboard is working.
4. Check floppy drive cable connection.
5. Replace floppy drive cable.
6. Replace floppy drive.
7. Replace motherboard.

Floppy Drive (Continued)

Disk does not eject

1 Switch off system and hold trackpad button down while you switch system on.

2 Eject disk manually by carefully inserting opened paper clip into hole near floppy drive slot.

3 If PowerBook serial number is between FC410 and FC414 or between CD412 and CK414, replace floppy drive.

4 Check floppy drive cable connection.

5 Reinstall floppy drive brackets. (Refer to "Floppy Drive" in Take Apart.)

6 Replace floppy drive cable.

7 Replace floppy drive.

8 Replace motherboard.

Floppy Drive (Continued)

Disk initialization
fails

1 Try known-good floppy disk.
2 Check floppy drive cable connection.
3 Replace floppy drive cable.
4 Replace floppy drive.

Read/write/copy
error

1 Try known-good floppy disk.
2 Check floppy drive cable connection.
3 Try application disk and data file on floppy disk.
4 Replace floppy drive cable.
5 Replace floppy drive.

Hard Drive

Internal hard drive
does not operate

1   Make sure power adapter is connected.
2   Disconnect external SCSI devices.
3   Check hard drive cable connection.
4   Use HD SC Setup to reinitialize drive.
5   Replace hard drive cable.
6   Replace hard drive.
7   Replace motherboard.

Peripheral

After you connect
external SCSI device,
computer does not
boot

1 Switch on external SCSI device before starting computer.
2 Check cable connections.
3 Verify that SCSI chain is terminated correctly.
4 Verify that SCSI select switch setting on external device is
   unique.
5 Verify operation of internal hard drive.
6 Try known-good external SCSI device.
7 Replace motherboard.

Peripheral (Continued)

Cursor does not move
when you are using
trackpad

1   Reset the power manager.
2   Check trackpad connections.
3   Check interconnect board, keyboard, and motherboard
    connections.
4   Connect low-power mouse and try to move cursor. If cursor
    moves, try using trackpad and keyboard. If trackpad does not
    move cursor, replace trackpad. If keyboard does not move
    cursor, replace keyboard.
5   Replace interconnect board.
6   Replace motherboard.

Peripheral **(Continued)**

Cursor intermittently does not move or moves erratically

1　Reset the power manager.
2　Clean trackpad surface.
3　Check trackpad connections.
4　Replace trackpad.
5　Replace keyboard.
6　Replace interconnect board.
7　Replace motherboard.

Cursor does not move when you are using mouse

1　Check mouse connection to ADB port.
2　Reset the power manager.
3　Clean mouse ball and inside mouse.
4　Replace mouse.
5　Replace motherboard.

Peripheral (Continued)

Cursor moves, but
clicking trackpad
button has no effect

1 Reset the power manager.
2 Check trackpad connections.
3 Check interconnect board, keyboard, and motherboard
   connections.
4 Replace trackpad.
5 Replace keyboard.
6 Replace interconnect board.
7 Replace motherboard.

No response to any
key on keyboard

1 Verify that computer is on.
2 Reset the power manager.
3 Check keyboard and interconnect board connections.
4 Replace keyboard.
5 Replace interconnect board.
6 Replace motherboard.

Peripheral **(Continued)**

Known-good direct-
connect printer does
not print

1　Verify that System is 7.1.1 or later.
2　Verify that Chooser and Control Panel settings are correct.
3　Check cables.
4　Replace printer cable.
5　Try known-good printer.
6　Replace daughterboard.
7　Replace motherboard.

Peripheral (Continued)

Known-good network printer does not print

1 Verify that System is 7.1.1 or later.
2 Verify that Chooser and Control Panel settings are correct.
3 Check cables.
4 Replace printer cable.
5 Try known-good printer. If printer works, troubleshoot network.
6 Replace daughterboard.
7 Replace motherboard.

In disk mode, computer does not display SCSI icon until host is booted, or computer crashes when host is shut down

Replace motherboard.

Peripheral (Continued)

Device connected to external modem port doesn't work

1. Verify that External Modem is selected in CDEV.
2. Verify that System is 7.1.1 or later.
3. Check cables.
4. Test device with known-good computer.
5. Replace daughterboard.
6. Replace motherboard.

I/O devices are unrecognized or garbage is transmitted or received

1. Verify that System is 7.1.1 or later.
2. Check cables.
3. Verify that SCSI device is correctly terminated.
4. Verify that SCSI select switch setting on external device is unique.
5. Test device with known-good computer.
6. Replace daughterboard.
7. Replace motherboard.

Internal Modem

Internal modem
options do not appear
in CDEV

1   Verify that System is 7.1.1 or later.
2   Reseat modem card.
3   Replace modem card.
4   Replace motherboard.

Modem does not
respond properly to
AT command set
instructions

1   Verify that baud rate and data format settings of
    communications application are compatible with internal
    modem and remote modem.
2   Check phone cord connection and operation.
3   Verify that System is 7.1.1 or later.
4   Reseat modem card.
5   Replace modem card.

Internal Modem (Continued)

Strange mix of characters appears on screen

1 Verify that baud rate and data format settings of communications application are compatible with internal modem and remote modem.
2 Check phone cord connection and operation.
3 Verify that System is 7.1.1 or later.
4 Reseat modem card.
5 Replace modem card.
6 Replace daughterboard.
7 Replace motherboard.

Modem interferes with system sound

1 Reseat modem card.
2 Replace modem card.
3 Replace interconnect board.
4 Replace motherboard.

Internal Modem (Continued)

Modem does not
respond to incoming
call

1   If computer is in sleep mode, verify that Wake On Ring
    option in CDEV is selected.
2   Check phone cord connection and operation.
3   Replace modem card.
4   Replace motherboard.

Modem has no sound
output

1   Verify that Control Panel volume setting is above 0.
2   Replace modem card.
3   Replace interconnect board.
4   Replace motherboard.

Internal Modem (Continued)

Modem connects but
does not communicate
with remote modem

1   Verify that remote modem needs error correction (error correction is internal modem default).

2   If remote modem does not need error correction, type   AT &Q0 to disable error correction.

Internal Modem (Continued)

You are using System 7.5 and two messages appear: "This Macintosh may not have been shut down properly" and "Incoming fax cannot be received because internal modem could not be identified..." Following the messages, the system "hangs."

1 Restart while holding down the Space bar. (This procedure will open Extensions Manager.)
   • Disable the PowerPort 500 control panel by removing the check mark.
   • Close the Extensions Manager window to complete startup.
   • Open the General Controls control panel and turn off the shutdown warning.
   • Open the Extensions Manager control panel and turn on the PowerPort 500 control panel.
   • Restart.
2 Restart with extensions off and remove the GlobalFax files, GlobalFax Personal folders, and PowerPort 500 from the System folder.
   • Reinstall the Global Village software.
   • Move the GlobalFax addresses into a new folder.

PCMCIA Module

PCMCIA card won't
eject

1   Make sure PCMCIA slot is not blocked.
2   Insert straightened paper clip into hole next to slot.

PCMCIA card is
inserted but doesn't
appear on desktop

If "defective card" or "unrecognizable card" appears in place of
card name in PCMCIA Eject control panel, card is damaged or
computer does not have software required to support it. Eject
card.

Miscellaneous

Screen goes blank and computer shuts down every few minutes

Computer is going into system sleep to conserve battery power. Adjust sleep delays in Control Panel or connect power adapter.

Application seems to run slower after a few seconds

Computer is switching to system rest. If system rest is interfering with operation of application, connect power adapter.

Hard drive is slow to respond, or screen goes blank too often

Adjust sleep delays in Control Panel or connect power adapter.

Miscellaneous (Continued)

No sound from speaker	1 Verify that volume setting in Control Panel is above 0. 2 Verify that no external speaker is plugged in. 3 Check connections of speaker to interconnect board and interconnect board to motherboard. 4 Replace interconnect board. 5 Replace motherboard.
System freezes intermittently, usually after being on for awhile	PowerBook 540/540c: Replace daughterboard (CPRC and international repairers only).
PowerBook clicks when closed	Reinstall center base cover, making sure screw nearest SCSI port is installed first. (See Take Apart.)

Take Apart

PowerBook 500 Series

Battery/PCMCIA Module

Before you begin, disconnect the power adapter.

Note: This procedure covers removal of the main battery, second battery or PCMCIA expansion module, and battery contact cover.

Important: Before removing the battery, use the Macintosh Shut Down command. Otherwise, all RAM contents will be lost.

Second Battery/
PCMCIA Module

Main Battery
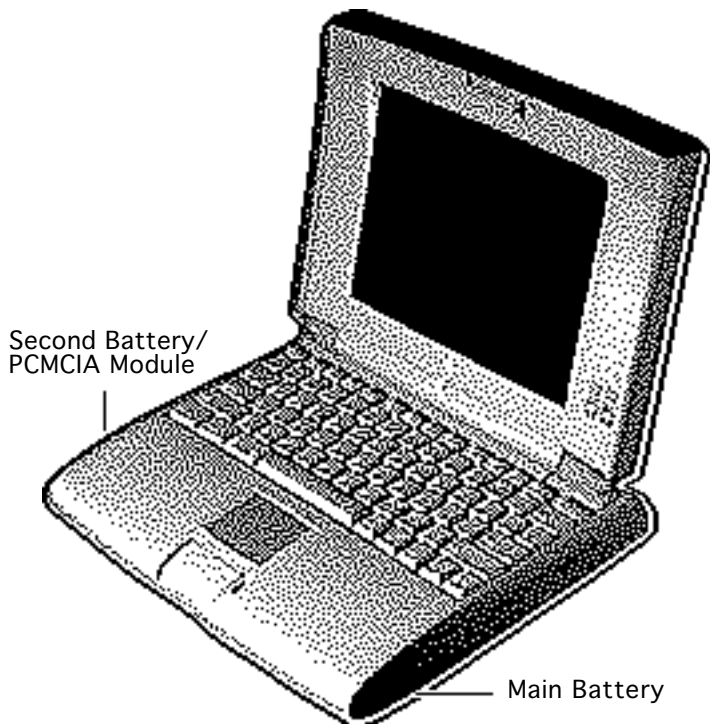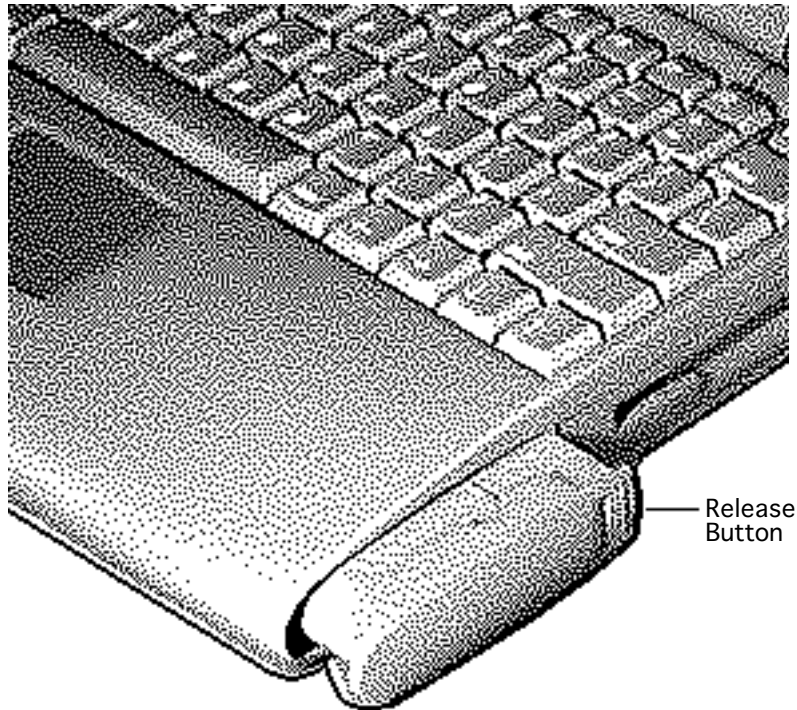
Caution: The PowerBook 500 Series contains devices that are very susceptible to ESD damage. To prevent damage, wear a grounding wriststrap. Review the ESD precautions in Bulletins/Safety.

1 Slide the release button toward you and pull out the main battery on the right side of the computer.

2 Repeat the procedure for the second battery, if installed, on the left side of the computer.

Release Button

Battery Contact Cover

3 If you are replacing the
   battery contact cover,
   press in on the sides of
   the cover and slide it off
   the main battery.
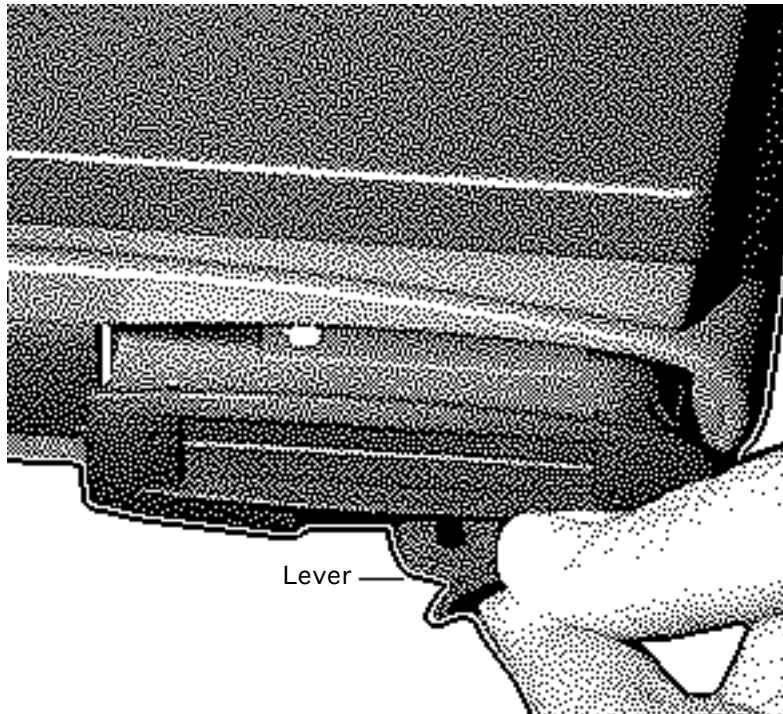
Lever

4 **Note:** Complete the following step if a PCMCIA expansion module is installed in the computer.

Using the tip of your finger, rotate the lever at the front of the PCMCIA module toward you.

5 **Note:** You may have to use some force when pulling the module out of the computer.

Holding onto the lever, pull the PCMCIA module out of the computer.

Keyboard

Before you begin, remove the battery/PCMCIA module.
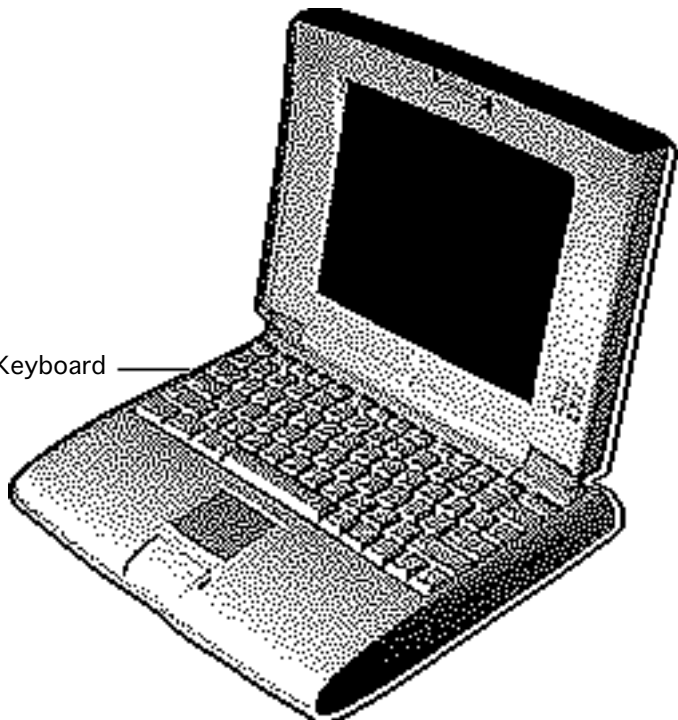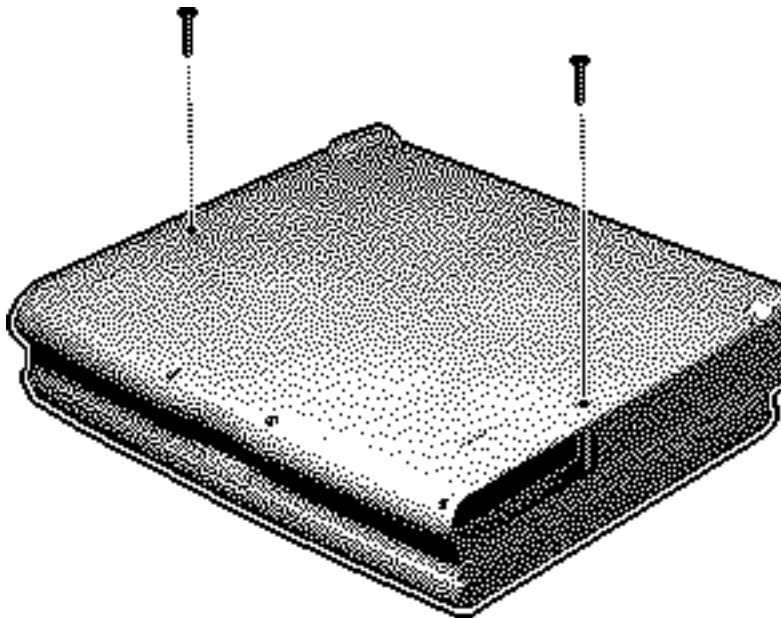
Keyboard

1 Using a T-8 torx driver, remove the middle two bottom housing screws.
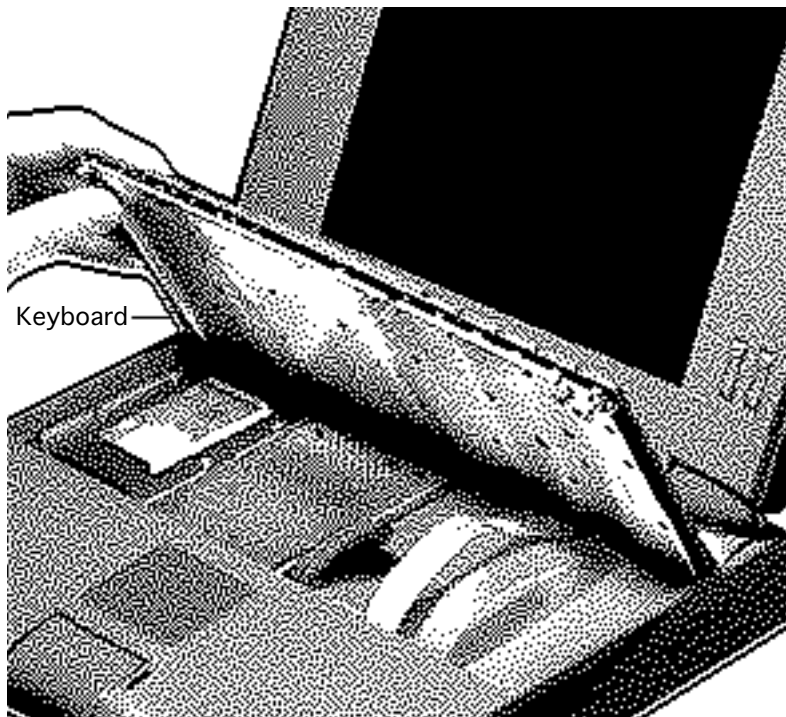
Keyboard

2 Using a small flat-blade screwdriver, lift the front of the keyboard and pull it forward slightly.

3 Rotate the keyboard so that it is perpendicular to the top cover.
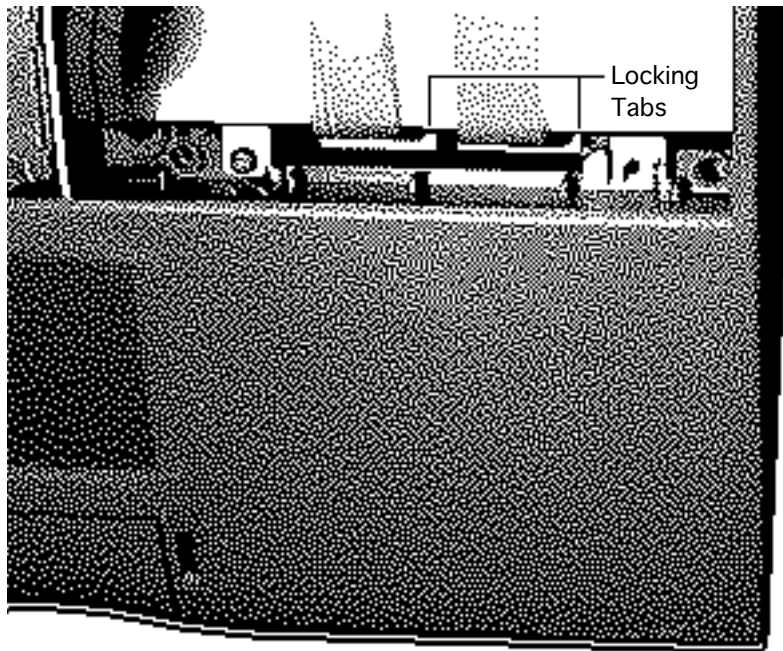
Locking Tabs

4 Release the locking tabs on the two keyboard cable connectors and disconnect the cables from the motherboard.

5 Lift off the keyboard.

Hard Drive

Before you begin, remove the following:

- Battery/PCMCIA module
- Keyboard
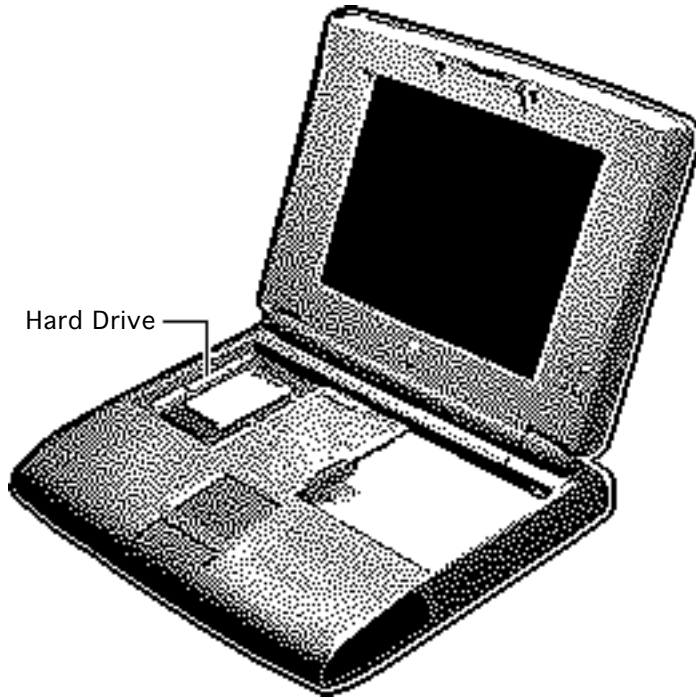
Hard Drive
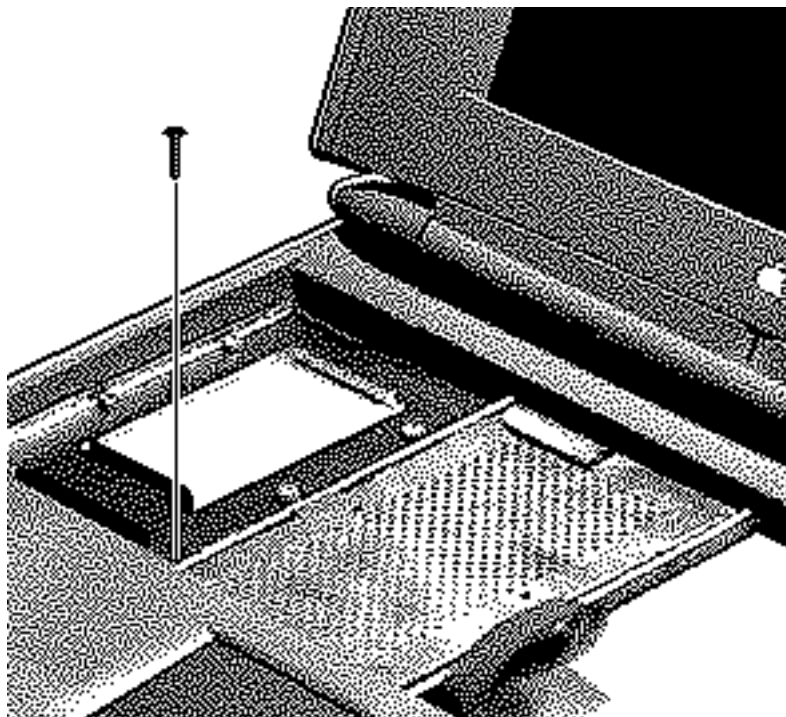
1   Using a T-8 torx driver, remove the hard drive mounting screw.

Hard Drive
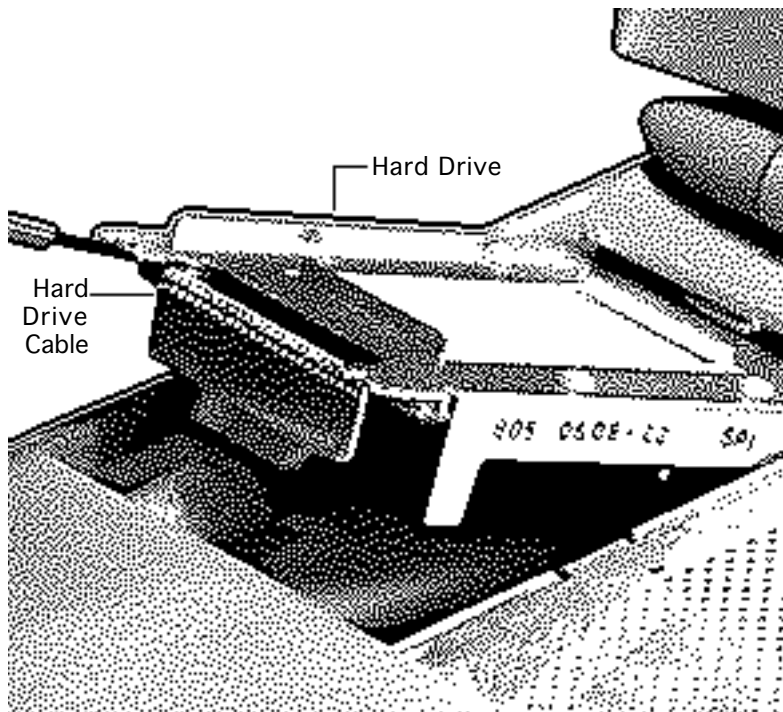
Hard Drive Cable

2   Using a small flat-blade screwdriver, pry up the front of the hard drive and slide it forward 1/2 inch.

3   **Note:** Use a rocking motion to disconnect the hard drive cable from the hard drive.

Lift the drive partway out of the unit and disconnect the hard drive cable.

4   Remove the hard drive.
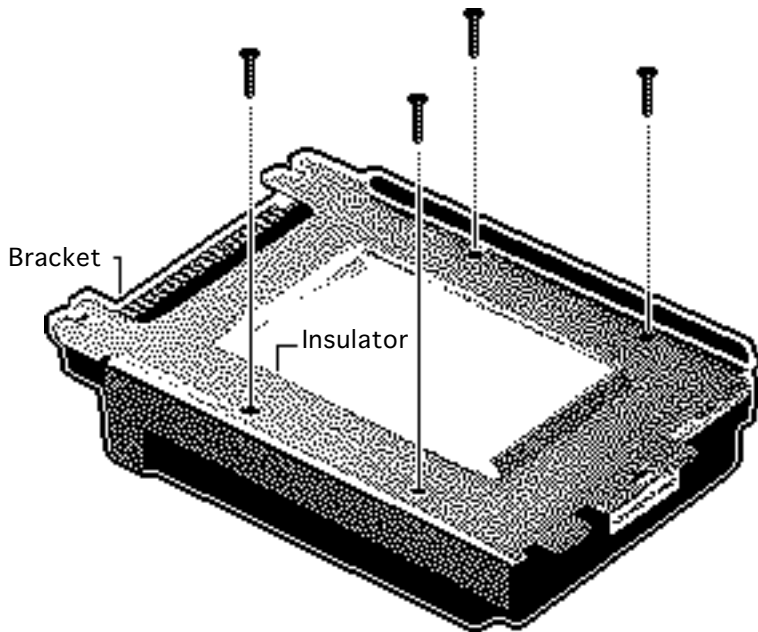
Bracket

Insulator

5 If you are replacing the hard drive, remove the four screws and remove the hard drive bracket and insulator.

   Replacement Note: Reinstall the hard drive bracket and insulator on the replacement hard drive.

Clutch Covers

Before you begin, remove the battery/PCMCIA module.

Clutch Cover
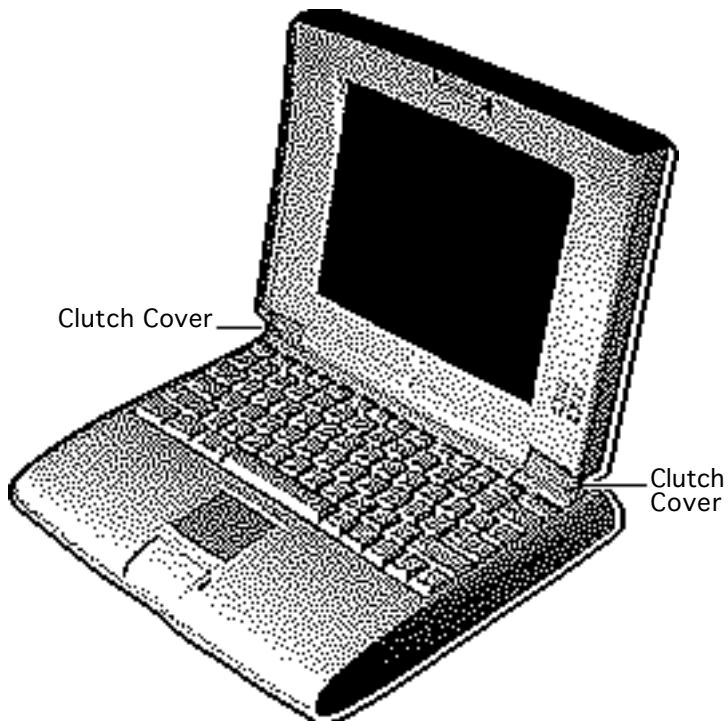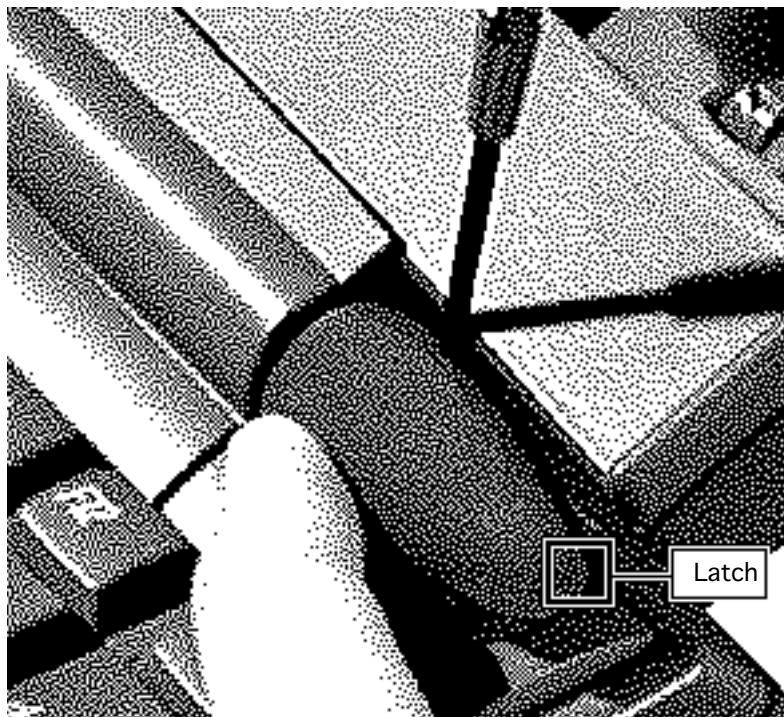
Clutch Cover

Latch

1   Open the unit and rotate the display assembly as far back as it will go.

2   Using a flat-blade screwdriver and your fingers, press in on both sides of the wide end of the right clutch cover and release the two front latches.

3   Rotate the clutch cover up, release the third latch, and remove the cover.

4   Repeat for the left clutch cover.

Replacement Caution: Be careful not to pinch or rip the display cable when you replace the right clutch cover.

Display Access
Cover

Before you begin, remove
the battery/PCMCIA module.
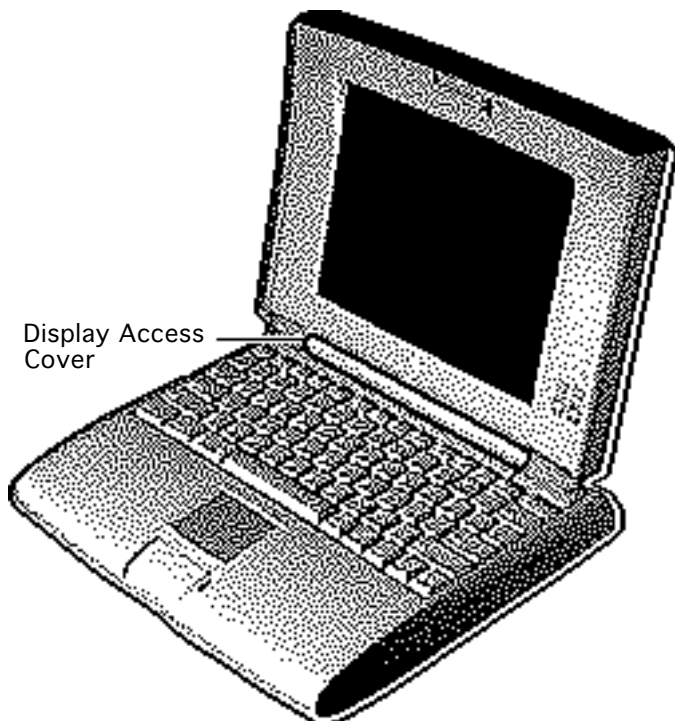
Display Access
Cover
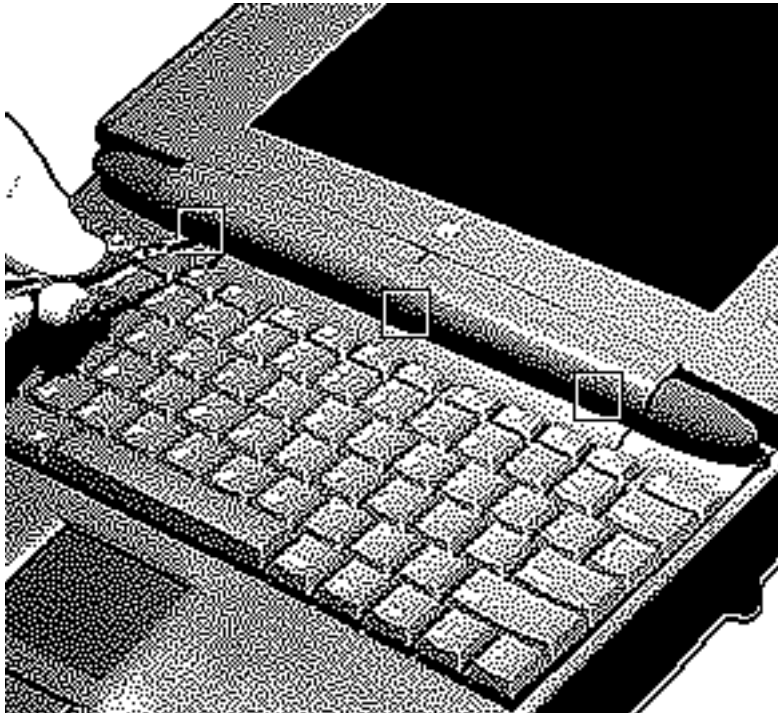
1 Open the unit and rotate the display assembly as far back as it will go.

2 Using a small flat-blade screwdriver, pry up the display access cover at the three slots in the front of the cover.

3 Remove the display access cover.

Display Assembly

Display Assembly

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
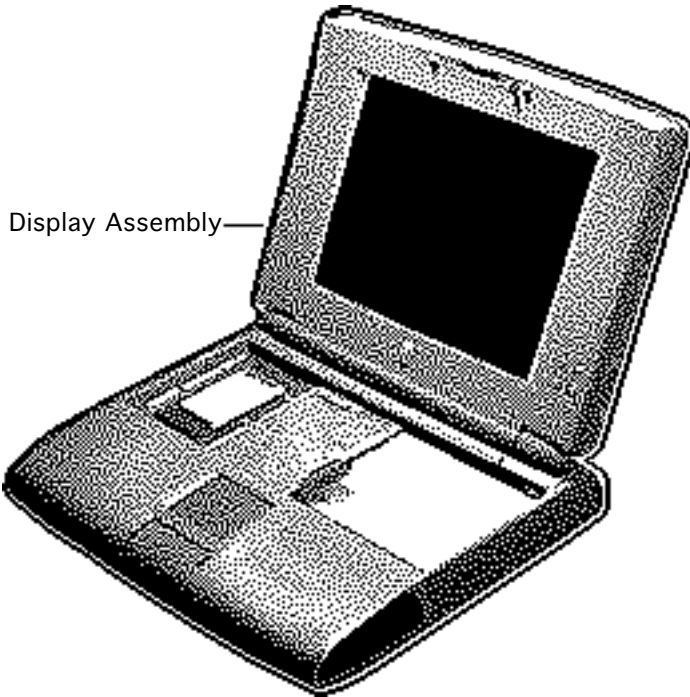
Interconnect-to-Logic Board Cable
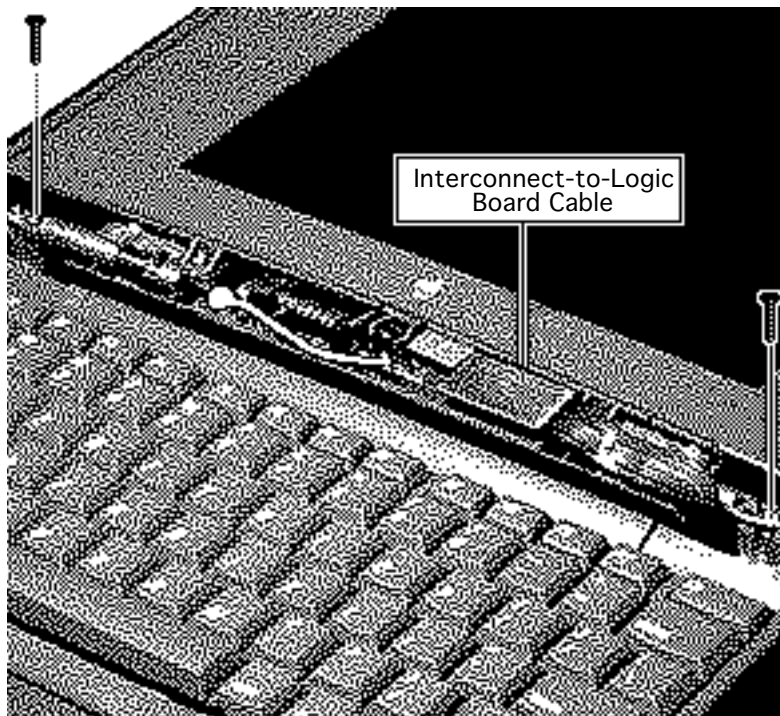
Caution: Support the display assembly from beneath before removing it.

1 Open the unit and rotate the display assembly as far back as it will go.

2 Disconnect the interconnect-to-logic-board cable.

3 Using a T-8 torx driver, remove the two display mounting screws.

4 Slide the display assembly to the left so that the right clutch clears the loop of the

interconnect-to-logic-
board cable.

5 Remove the display
   assembly.

Center Base Cover

Before you begin, remove the following:

- Battery/PCMCIA module
- Keyboard
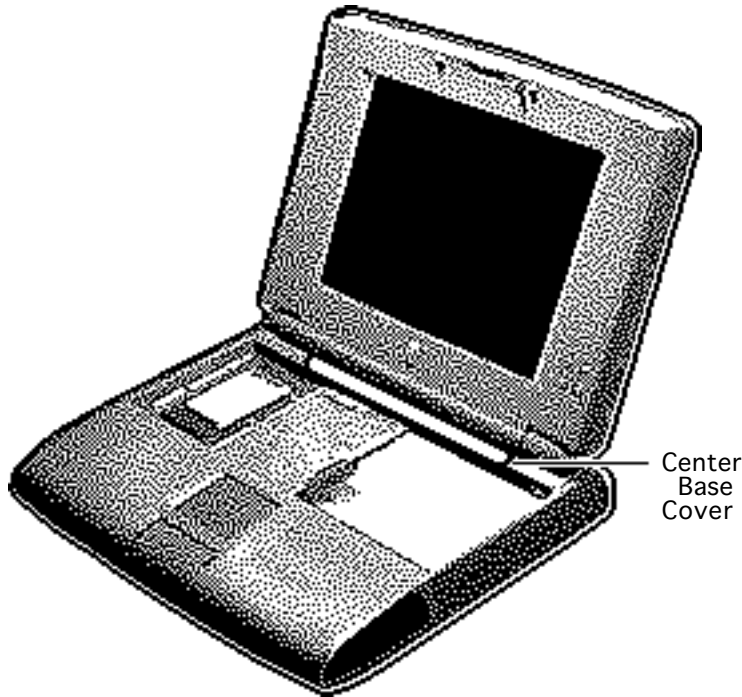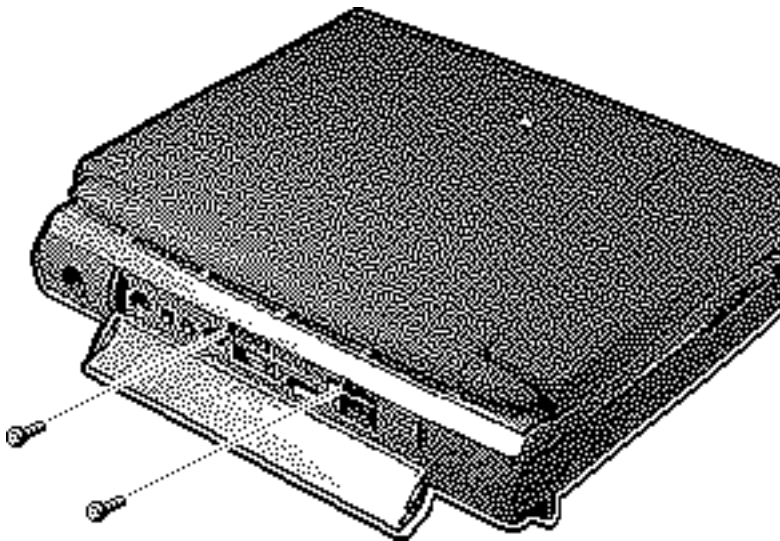
Center Base Cover

1 Using a T-8 torx driver, remove the two rear panel screws.

   Replacement Caution: When replacing the rear panel screws, be sure to install the right screw first (the screw nearest the SCSI port).
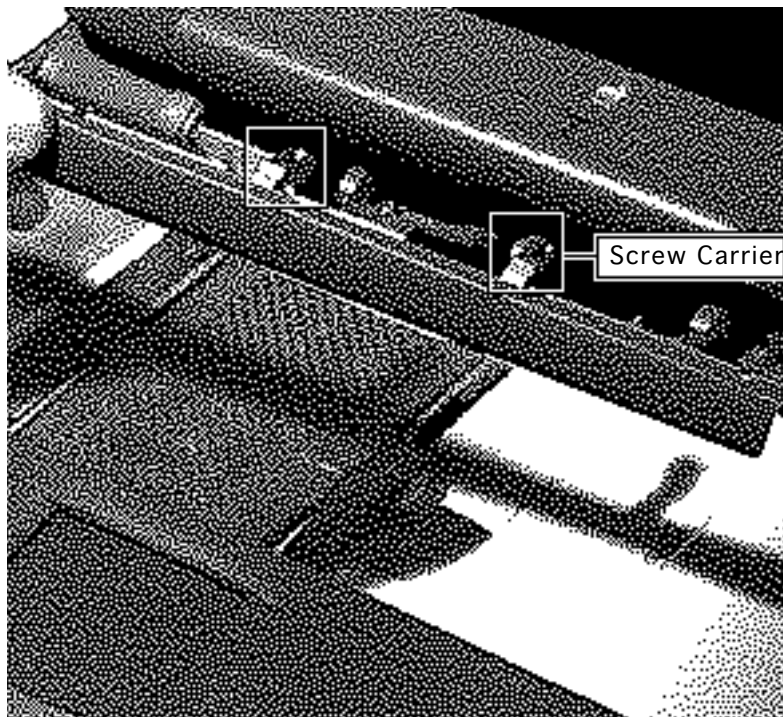
Screw Carrier

2 Pull the center base cover forward slightly and slide it 1/2 inch to the right to release the two screw carriers.

3 Remove the center base cover.

Floppy Drive

Floppy Drive

Before you begin, remove the following:

- Battery/PCMCIA module
- Keyboard
- Center base cover
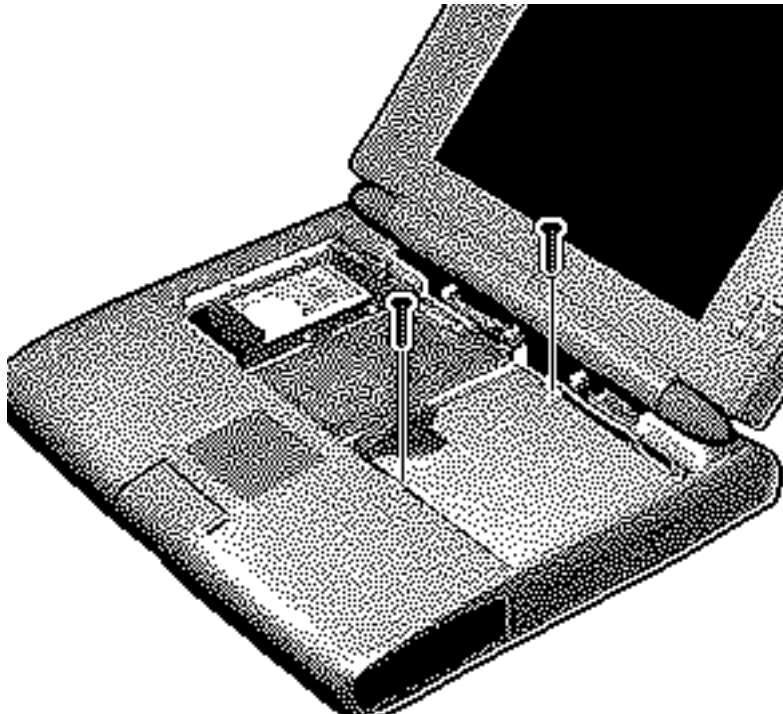
1   Using a T-8 torx driver,
    remove the two floppy
    drive screws.
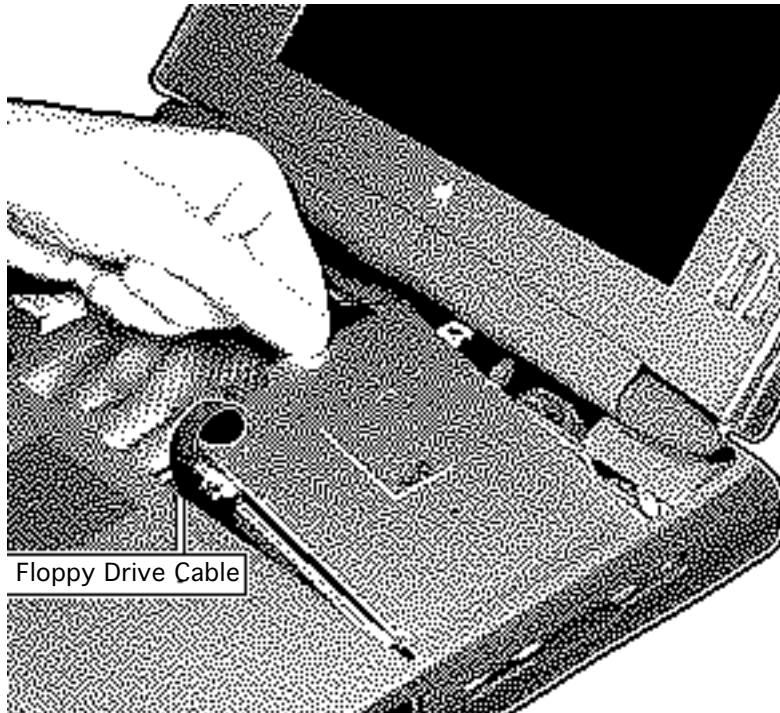
Floppy Drive Cable

2 Using a small flat-blade screwdriver, pry up the cable end of the floppy drive and slide the drive 1/2 inch to the left.

3 Slide the drive forward slightly and lift it partway out of the unit.

4 Disconnect the floppy drive cable from the motherboard and remove the drive.
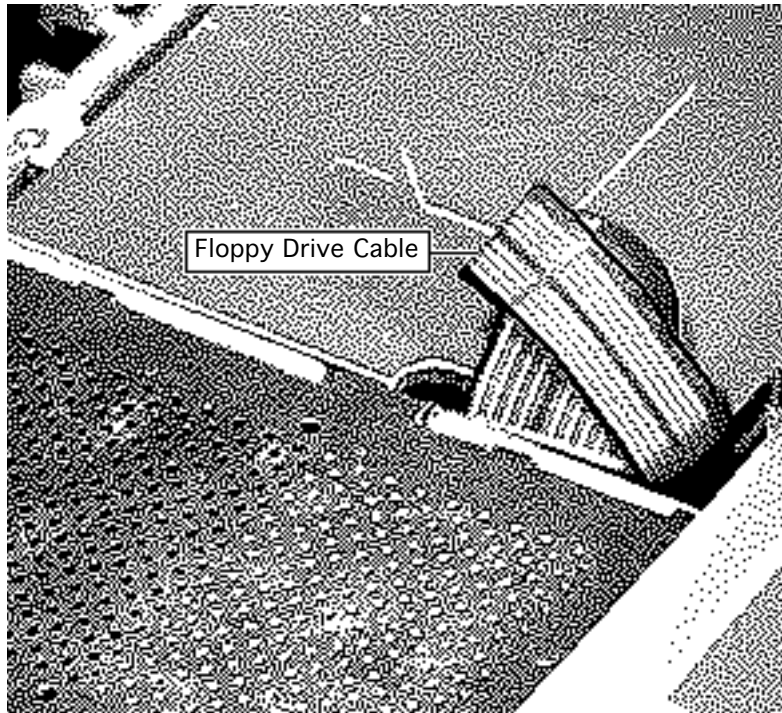
Floppy Drive Cable

Replacement Caution:
Before disconnecting the floppy drive cable from the drive, note the cable folds and the correct orientation of the cable connection. Because the cable connector is not keyed, the floppy drive cable could be reinserted upside down.

Replacement Caution:
When you reinstall the floppy drive, make sure the floppy drive cable folds on top of the drive, not below it.

Locking Tab

Floppy
Drive
Cable

5 If you are replacing the floppy drive or floppy drive cable, release the locking tabs and disconnect the cable from the drive.
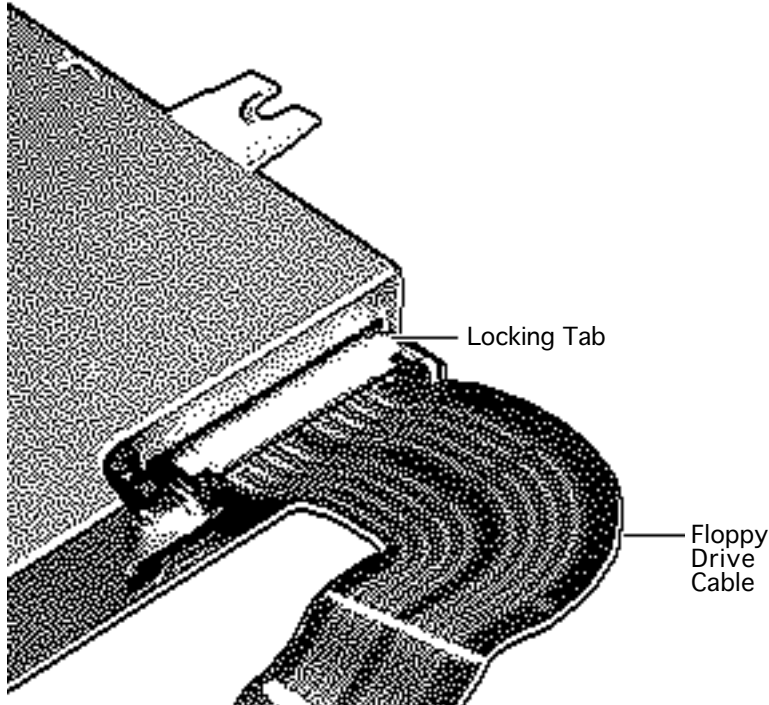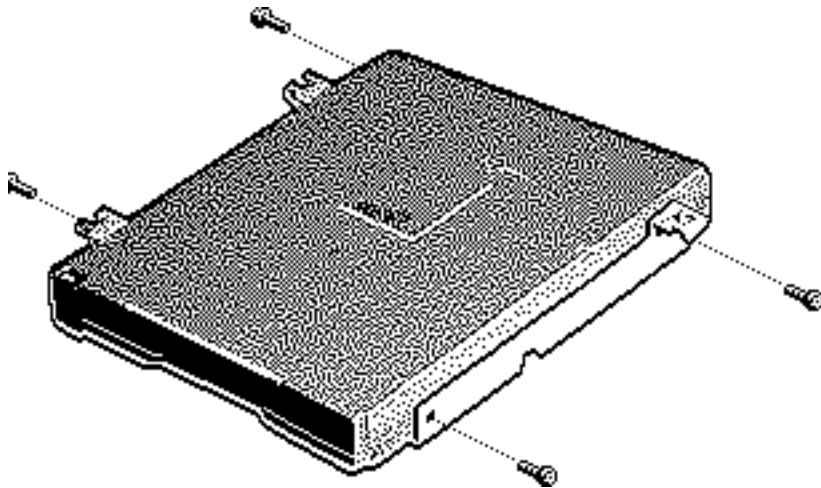
6   If you are replacing the floppy drive, remove the two right bracket screws and remove the right bracket.

7   Remove the two left bracket screws and remove the left bracket.
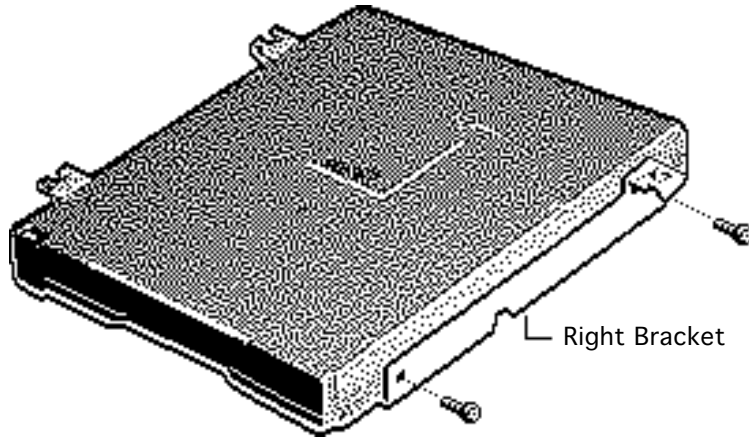
Right Bracket

Replacement Note:
Reinstall the floppy
drive brackets and
floppy drive cable on
the replacement floppy
drive. Use the following
procedure for the
brackets:

• Start the screws in
  the right bracket.
• Push the front of the
  bracket toward the
  top of the floppy drive.
• Hold the bracket in
  this position and
  retighten the screws.
• Repeat for the left
  bracket.

Replacement Caution:
If the brackets are not pushed toward the top of the floppy drive, the floppy disk may not eject properly.

Daughterboard EMI Shield

Daughterboard EMI Shield

Before you begin, remove the following:

- Battery/PCMCIA module
- Keyboard
- Center base cover

Daughterboard
EMI Shield
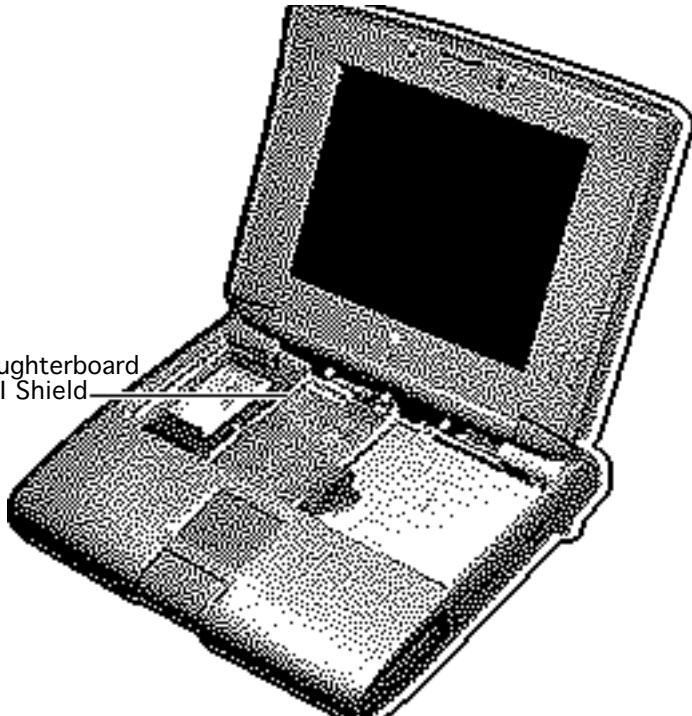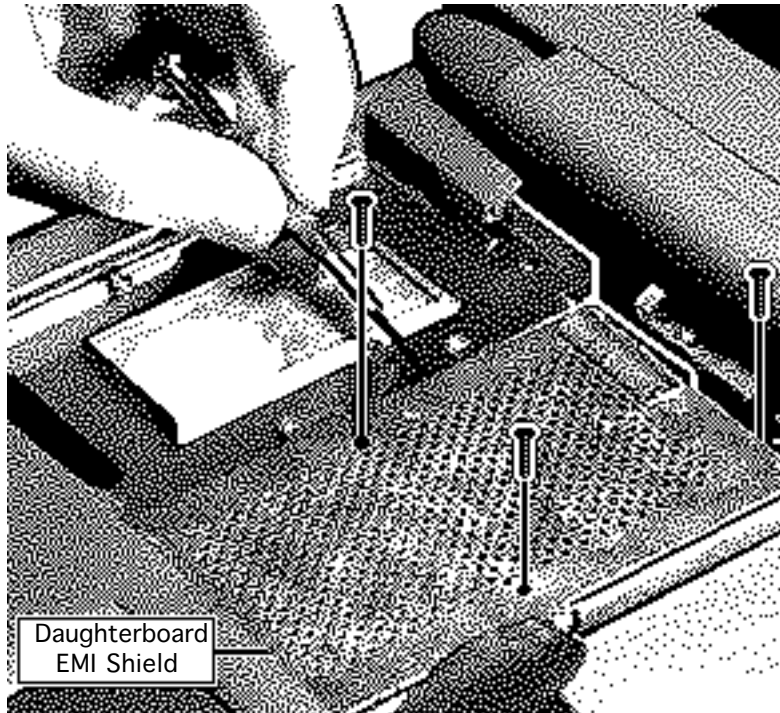
1. Remove the three mounting screws.

2. Using a small flat-blade screwdriver, pry up and remove the daughterboard EMI shield.

Replacement Caution: Make sure all the tabs on the sides of the shield fit inside the daughterboard guide.
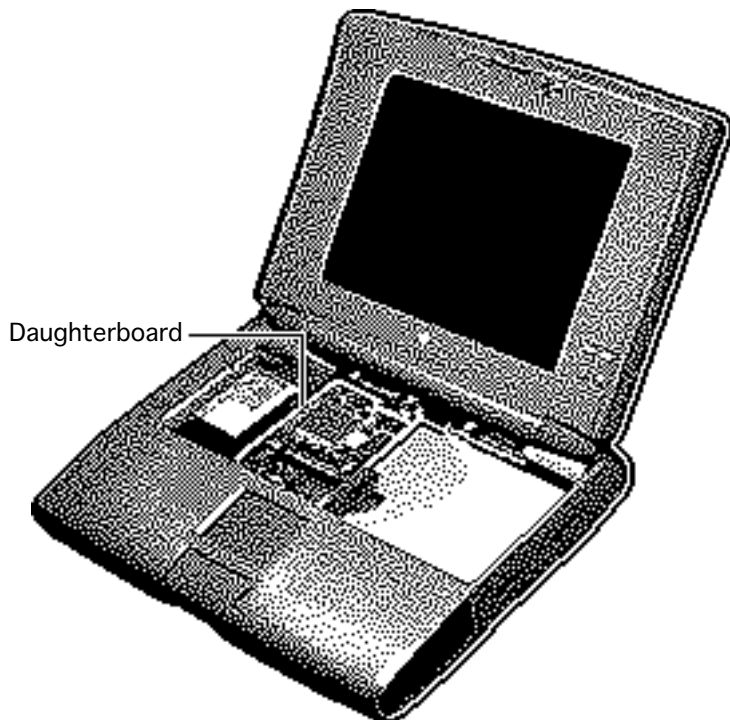
Daughterboard —

Daughterboard

Before you begin, remove the following:

- Battery/PCMCIA module
- Keyboard
- Center base cover
- Daughterboard EMI shield
- RAM card (if installed)
- Modem card (if installed)
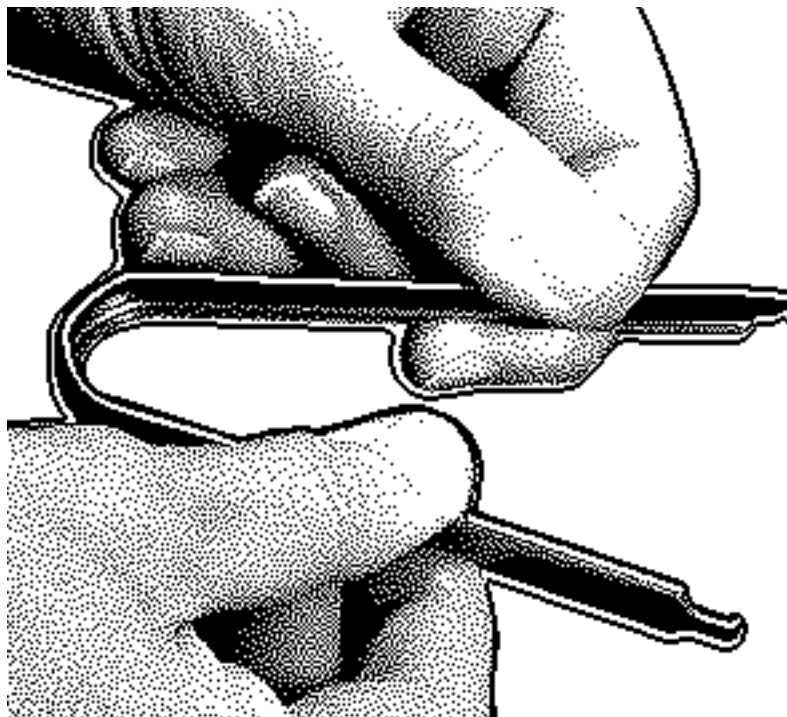
Note: To remove the daughterboard, you will need to adapt an IC extractor so that it has a wide grip.

1 Grasp an IC extractor by the legs and pull outward.

Daughterboard

RAM Expansion Connector

Daughterboard Connector

Notch
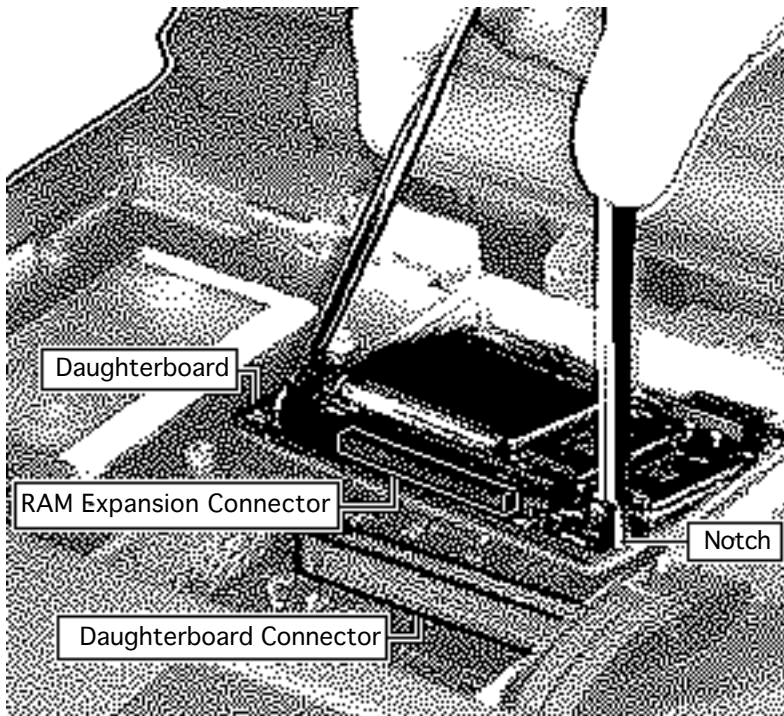
2 Remove the plastic retainer bar.

3 **Note:** The daughterboard is connected to the motherboard below the RAM card connector.

   Caution: You may have to use some force to disconnect the daughterboard. Use an IC extractor, as illustrated. Do not pry up the board with a screwdriver.

   Place the legs of the IC extractor in the notches at the end of the daughterboard and pull up.

Top Case
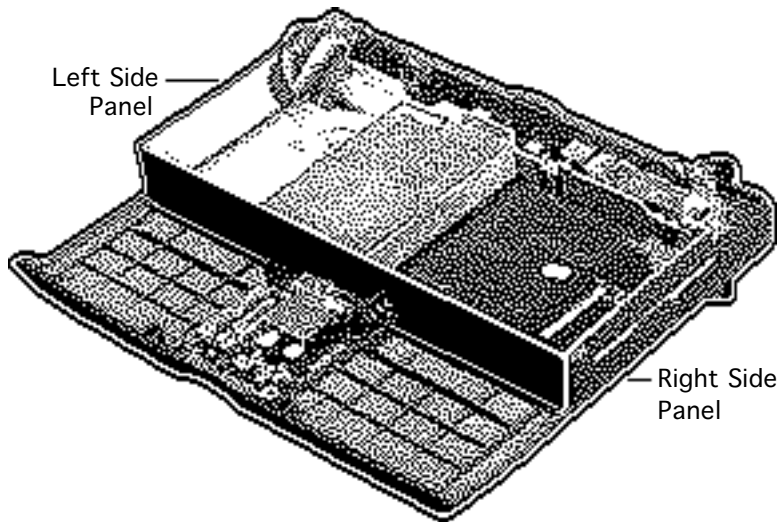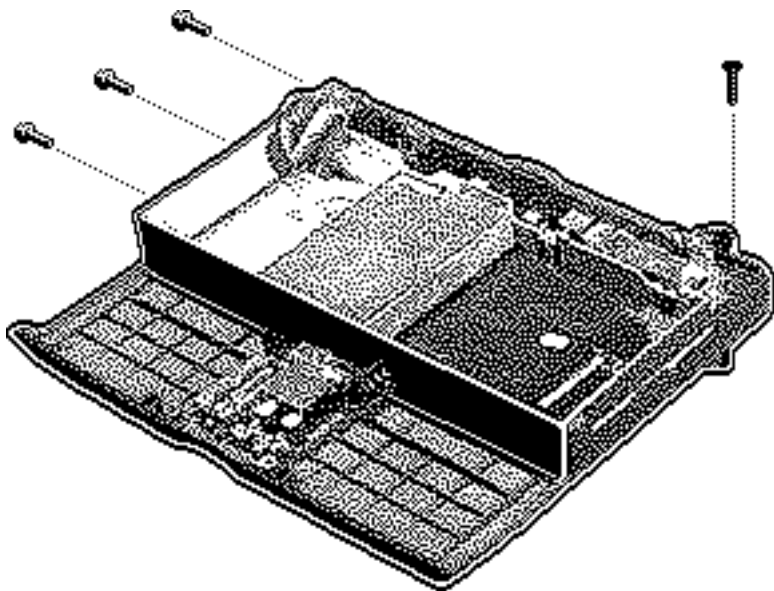
Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive

Top Case

Small Screw

Small Screw
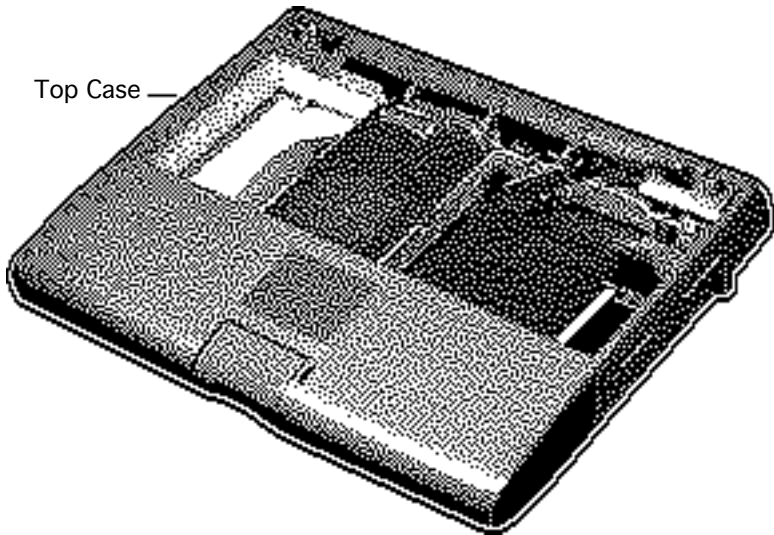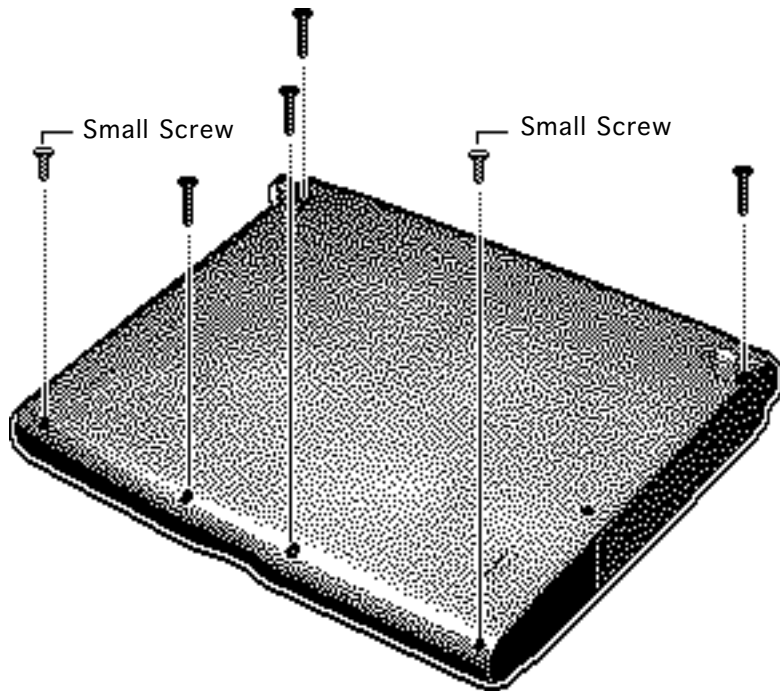
1 Rotate the feet to the up position.

2 Using a T-8 torx driver, remove the screw located under each foot.

3 Remove the four screws at the front edge of the bottom case.

4   Remove the remaining
    screw on the inside top
    edge of the case.

Trackpad Cable

Trackpad Cable Connector
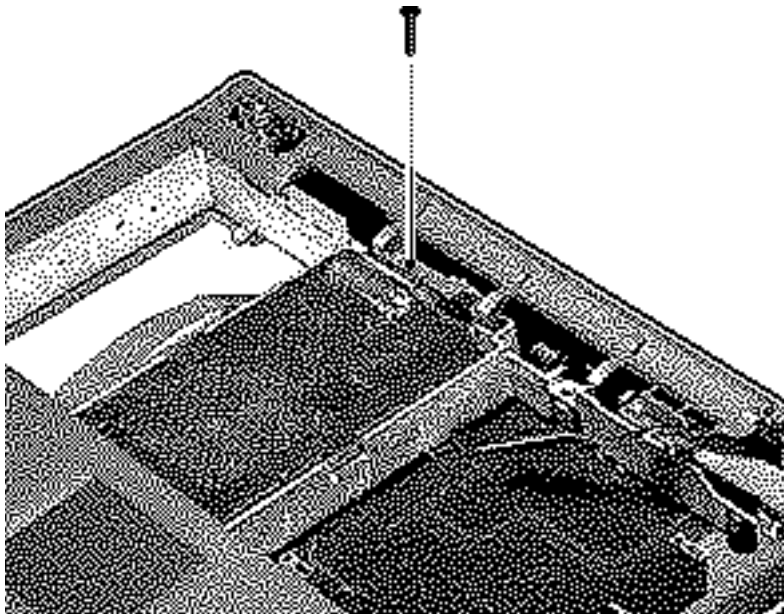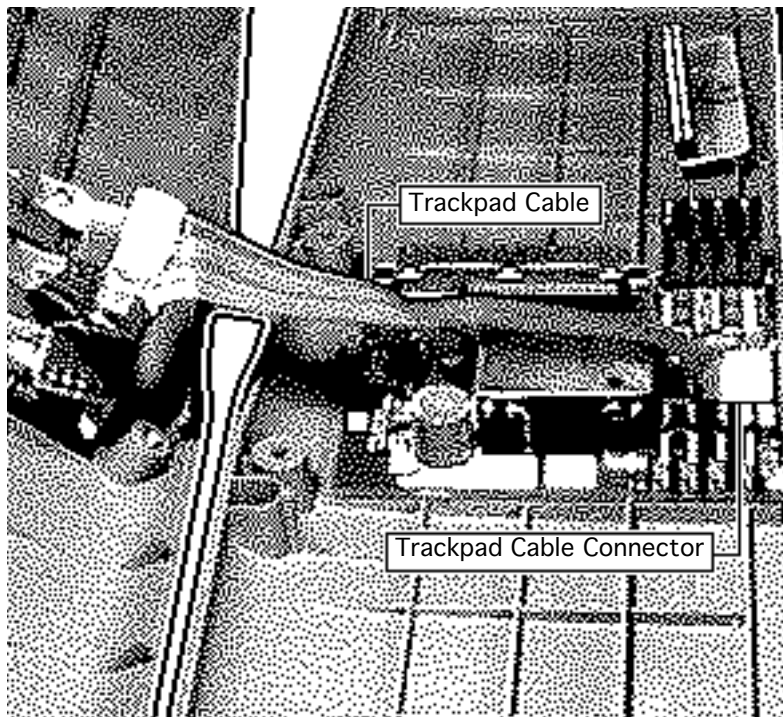
5　**Caution:** The top case is connected to the motherboard by the trackpad cable. Be careful not to lift the top case too far off the unit or you may damage the cable.

Carefully lift and rotate the top case toward you and disconnect the trackpad cable from the motherboard.

Interconnect-to-Logic
Board Cable

Right Clutch
Opening

EMI Clip
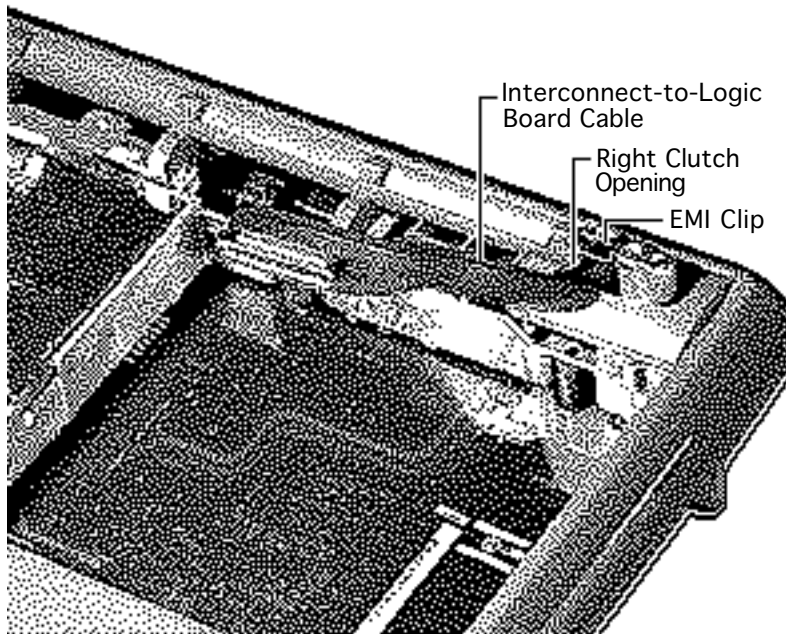
6   Remove the
    interconnect-to-logic
    board cable from the
    opening for the right
    clutch.

7   Remove the top case.

Replacement Note: Before
securing the top case to the
bottom case, thread the
interconnect-to-logic
board cable through the
opening for the right
clutch. Form a loop around
the EMI clip by wrapping
the cable from behind and
then over and under the clip.

Fuse

Fuse

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive
- Top case
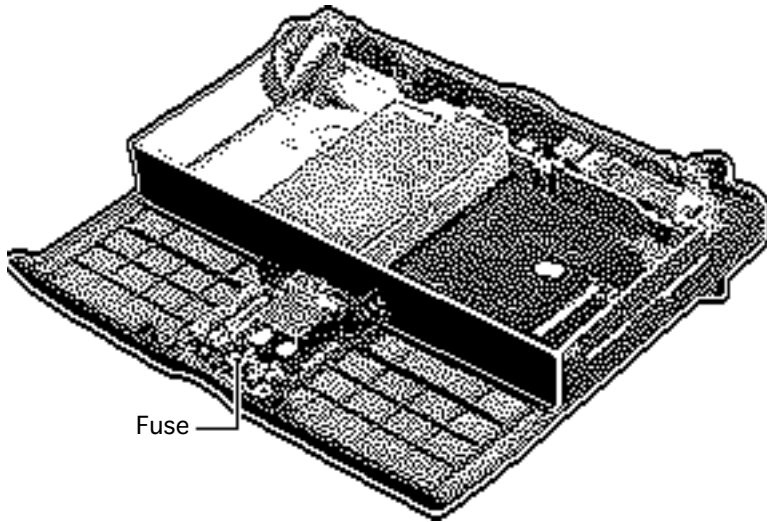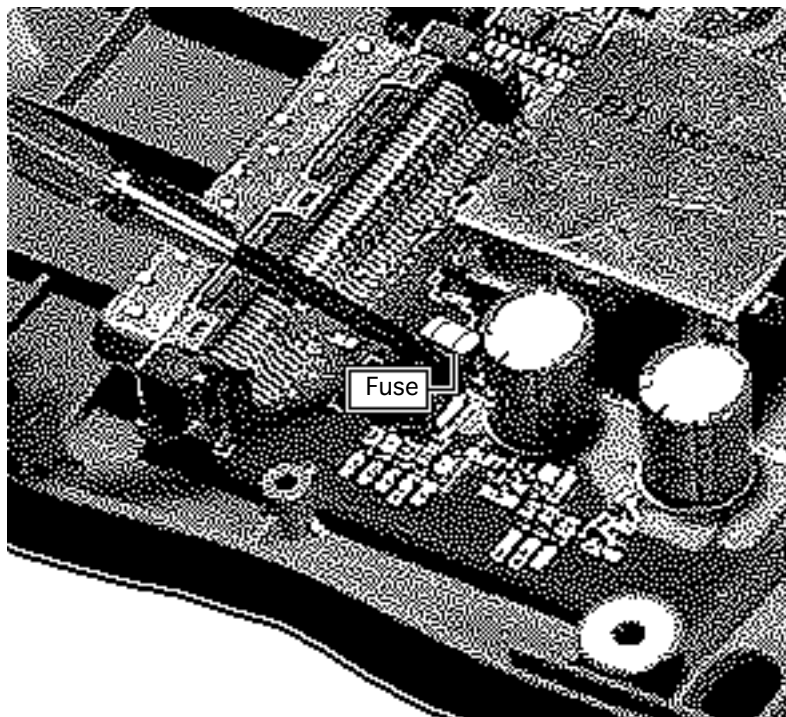
Using a small flat-blade screwdriver, pry up and remove the fuse.

Fuse

Interconnect-to-Logic-Bd. Cable

Interconnect-to-Logic-Board Cable

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive
- Top case

Interconnect-to-Logic-Board Cable
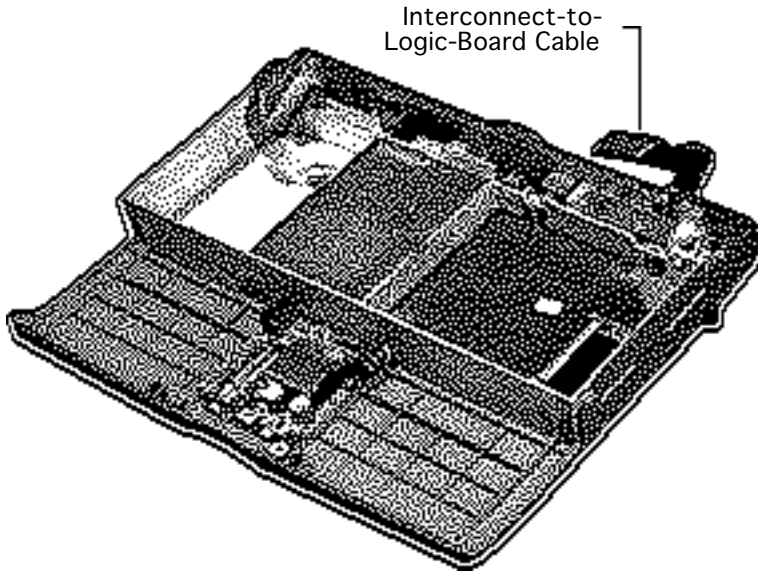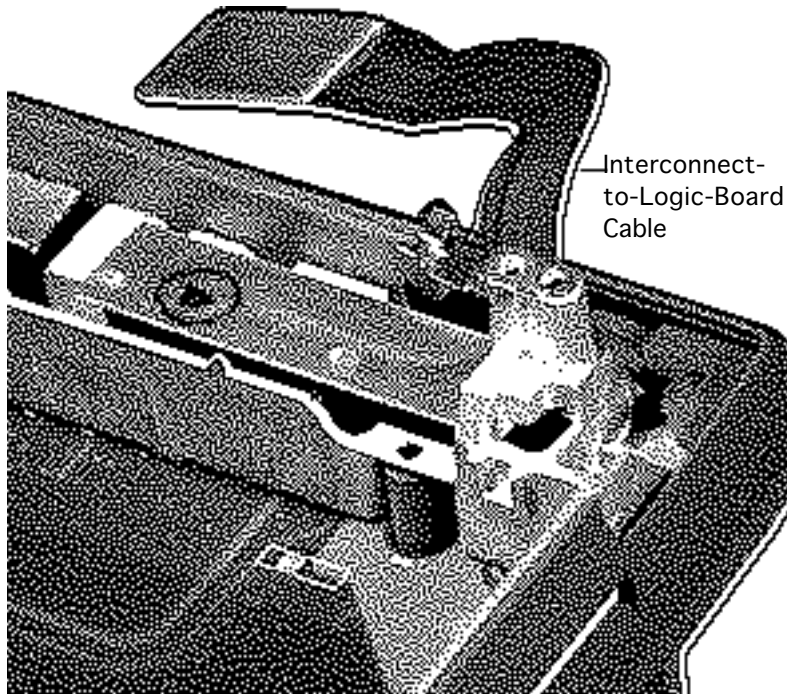
Caution: Before disconnecting the interconnect-to-logic-board cable, note the correct orientation of the cable connection. Because the connector is not keyed, the cable could be reinserted upside down.

Disconnect the interconnect-to-logic-board cable from the motherboard and remove the cable.

Side Panels

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive
- Top case

Left Side Panel

Right Side Panel

1 Using a T-8 torx driver, remove the right side-panel mounting screw.

2 Lift the panel slightly, slide it back, and remove it from the CPU stiffener.

3 Using a T-8 torx driver, remove the three left side-panel mounting screws.

4 Slide the panel to the left and remove it from the CPU stiffener.

CPU Stiffener

CPU Stiffener

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive
- Daughterboard EMI shield
- Top case
- Interconnect-to-logic-bd. cable

Left Side Panel
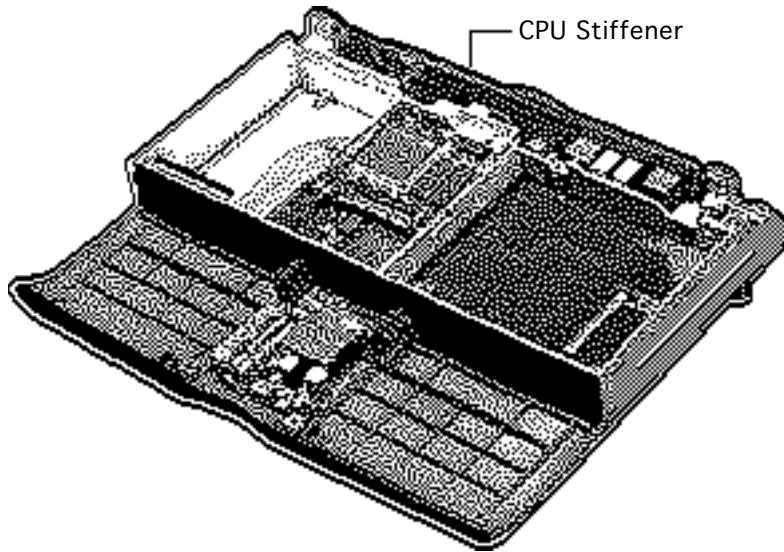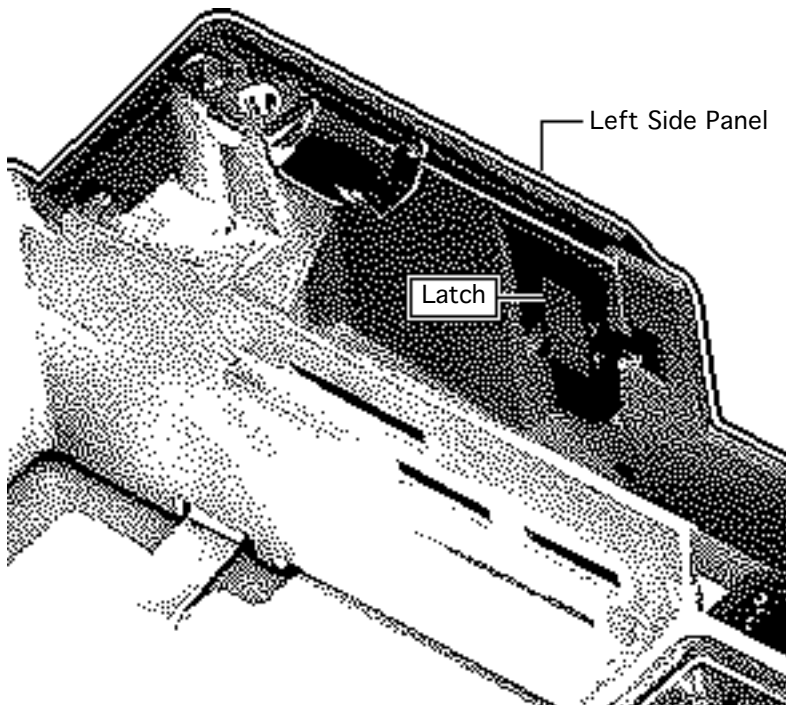
Latch

Note: In this take-apart procedure, the CPU stiffener is removed with the side panels attached. This procedure also explains how to remove the panels from the stiffener.

1 Unlatch the left side panel from the back panel.
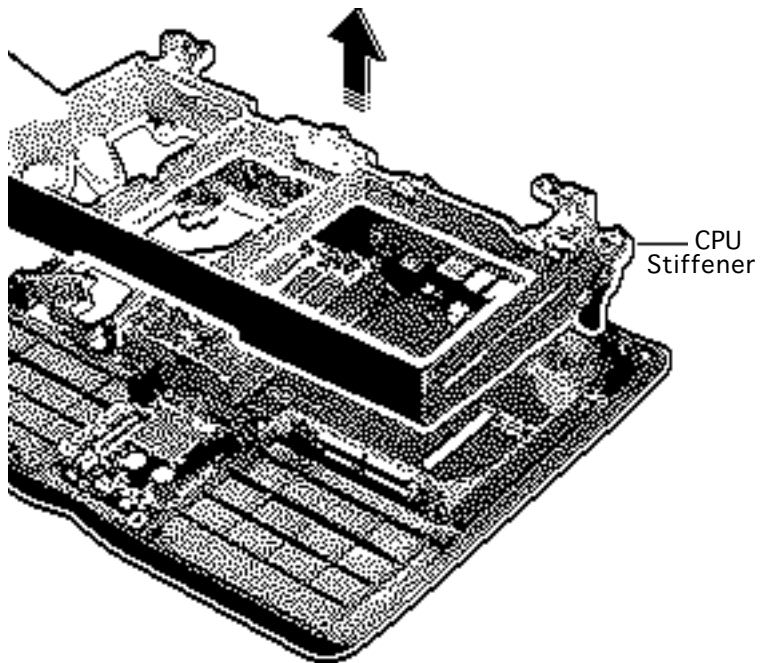
CPU Stiffener

2 Rotate the feet to the up position.

3 Lift the CPU stiffener straight off the unit.
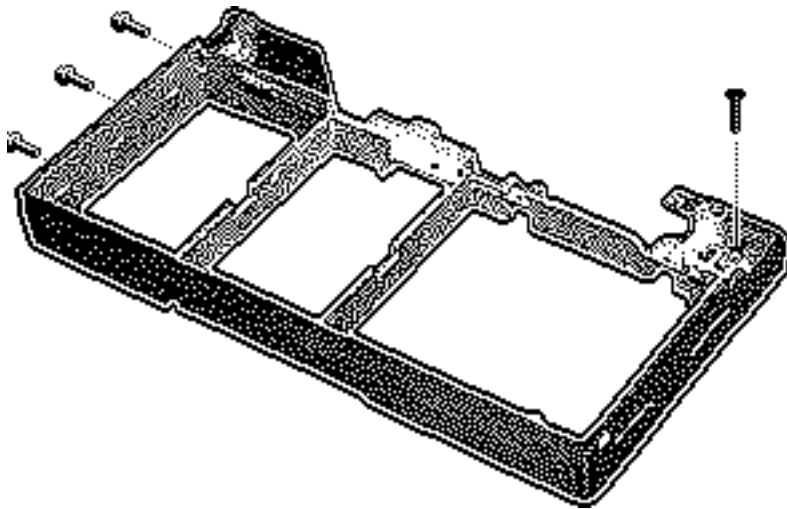
Note: If you are replacing the CPU stiffener, remove the side panels.

4 Using a T-8 torx driver, remove the right side-panel screw.

5 Lift the panel slightly, slide it back, and remove it from the CPU stiffener.

6 Using a T-8 torx driver, remove the three left side-panel screws.

7 Slide the panel to the left and remove it from the CPU stiffener.
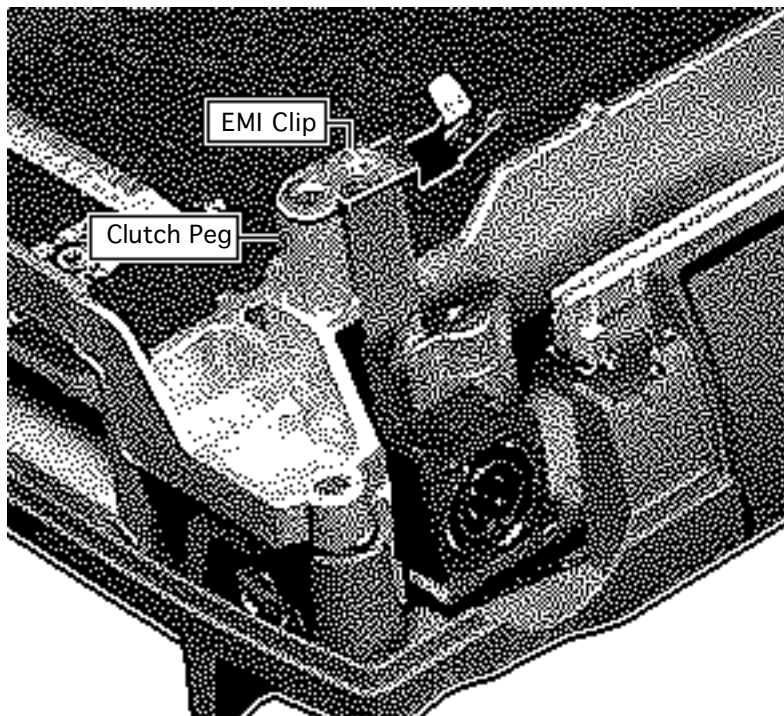
Replacement Caution: Make sure both EMI clips fold on top of the clutch pegs. If the right clip accidentally folds backward and touches the pins for the power connector, the contact could short out the motherboard.
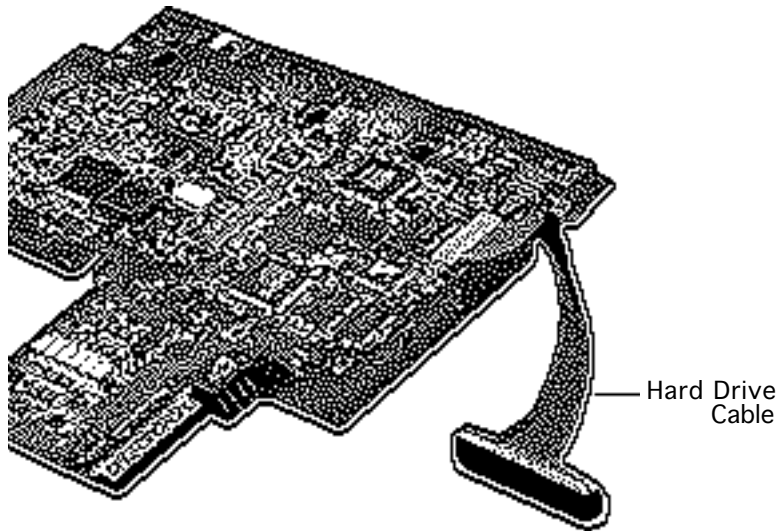
Motherboard

Motherboard

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive
- Daughterboard EMI shield
- Top case
- Interconnect-to-logic-bd. cable
- CPU stiffener
- DAA card (if installed)

Sound-In Port

Sound-Out Port
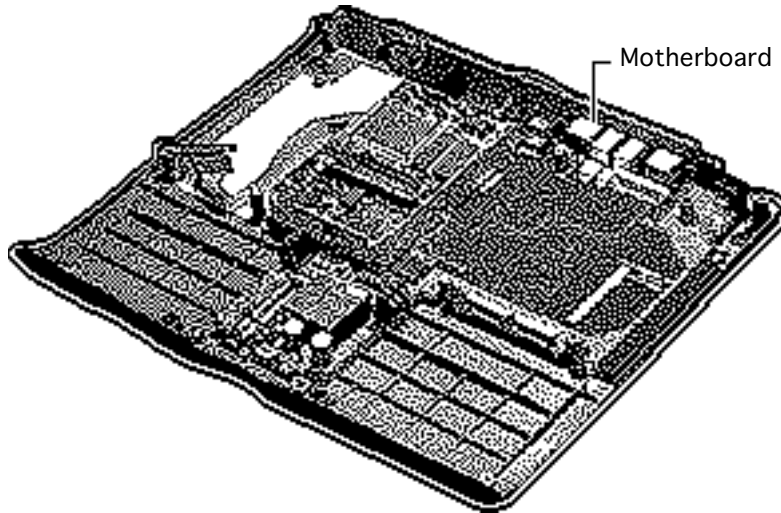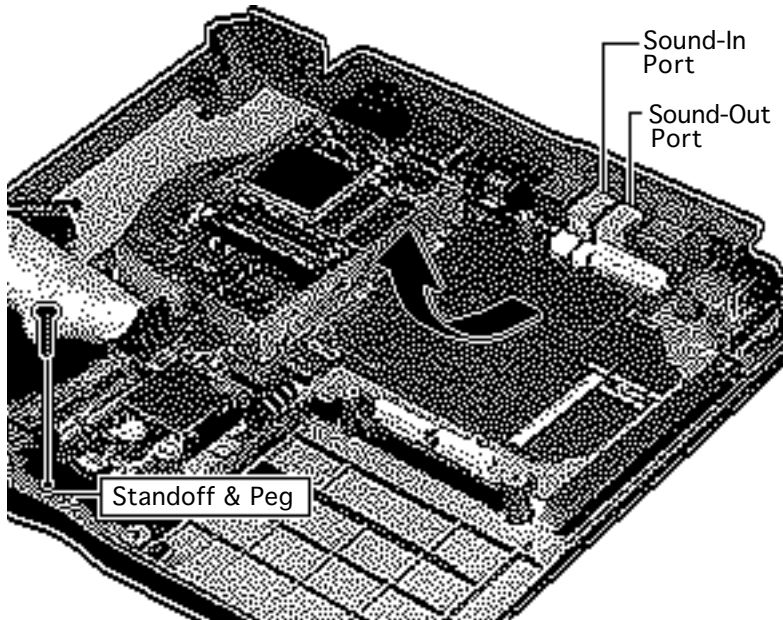
Standoff & Peg

1 Remove the motherboard mounting screw and standoff.

2 Carefully pry the motherboard from the positioning peg located below the standoff.

3 Slide the board forward 1/4 inch.

4 **Caution:** In lifting the motherboard, be careful that the sound-in and sound-out ports clear the openings in the rear panel.

   Lift off the motherboard.
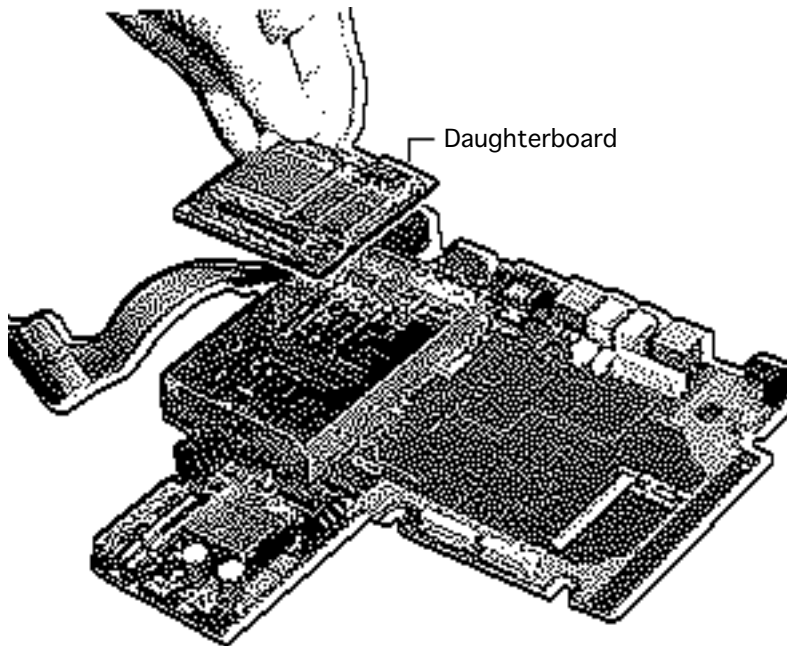
Daughterboard

5 If you are replacing the
   motherboard, discon-
   nect the RAM card (if
   installed), daughter-
   board, and modem card
   (if installed).
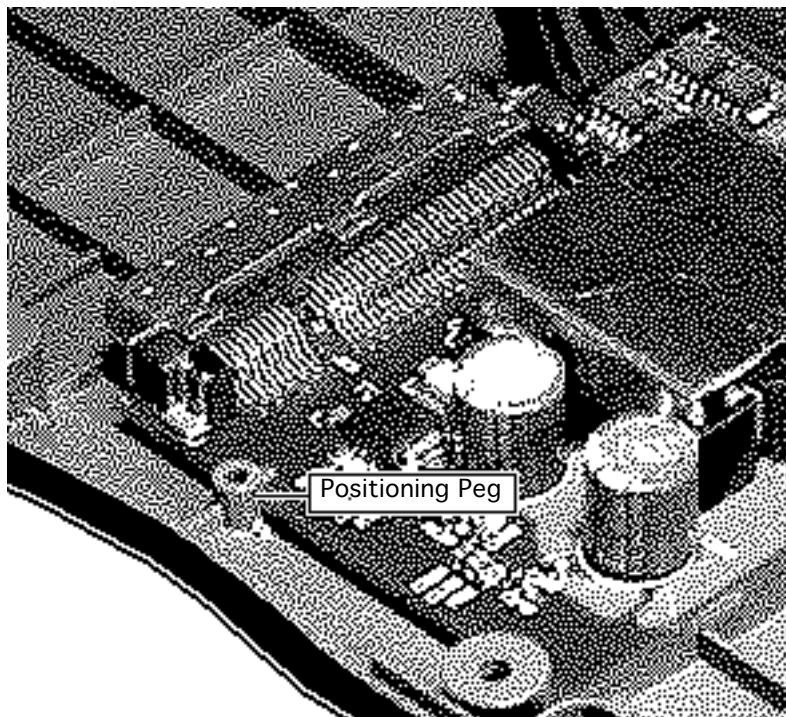
Positioning Peg

Replacement Note: Make sure the front of the motherboard fits securely below the positioning peg on the bottom case.

Hard Drive Cable
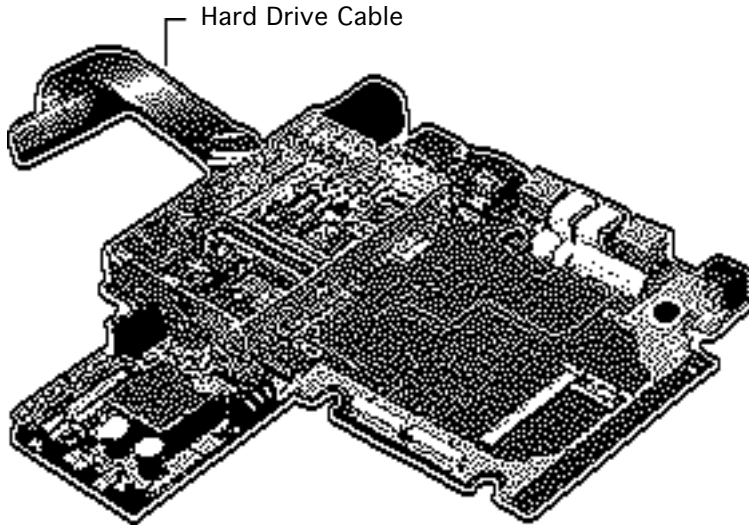
Hard Drive Cable

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive
- Daughterboard EMI shield
- Top case
- Interconnect-to-logic-bd. cable
- CPU stiffener
- Motherboard

1 Turn over the motherboard.

2 Disconnect the hard drive cable from the motherboard.

Hard Drive Cable

Rear Door

No preliminary steps are required.
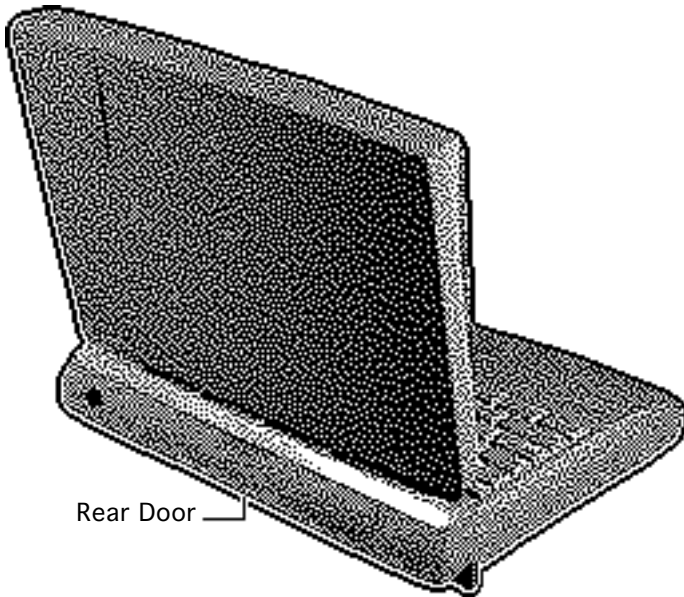
Rear Door
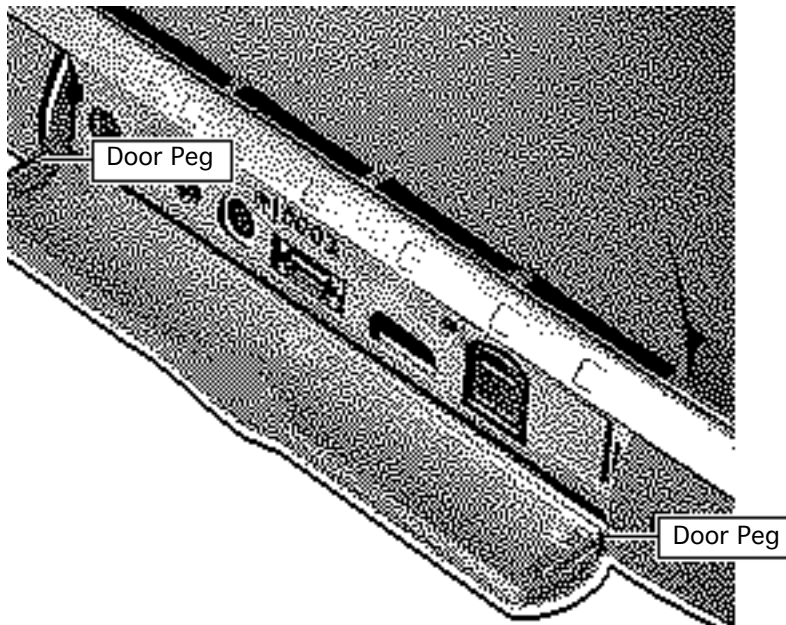
1 Open the rear door.

2 Carefully bend the door so that the middle bows downward.

3 Unhinge the bottom door pegs and remove the rear door.

Bottom Case

Bottom Case

To remove the bottom case, remove the following:

- Battery/PCMCIA module
- Rear door
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive
- Daughterboard EMI shield
- Top case
- Interconnect-to-logic-bd. cable
- Side panels
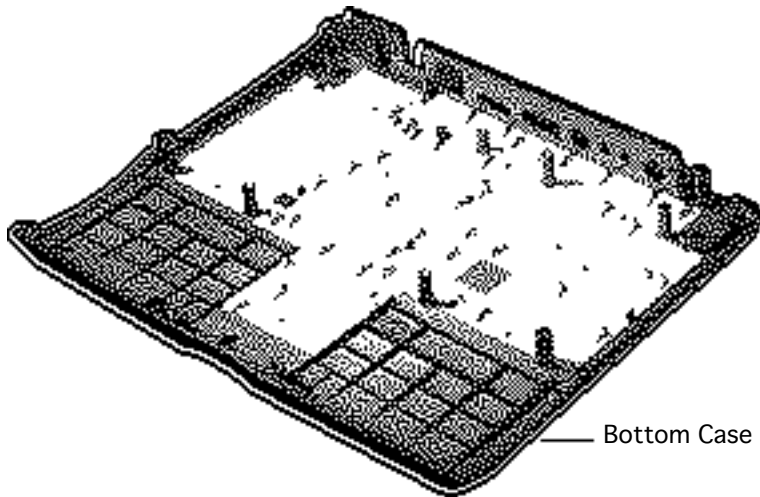
- CPU stiffener
- Motherboard

Microphone Assembly

Microphone Assembly

Before you begin, remove the following:

- Battery/PCMCIA module
- Display access cover
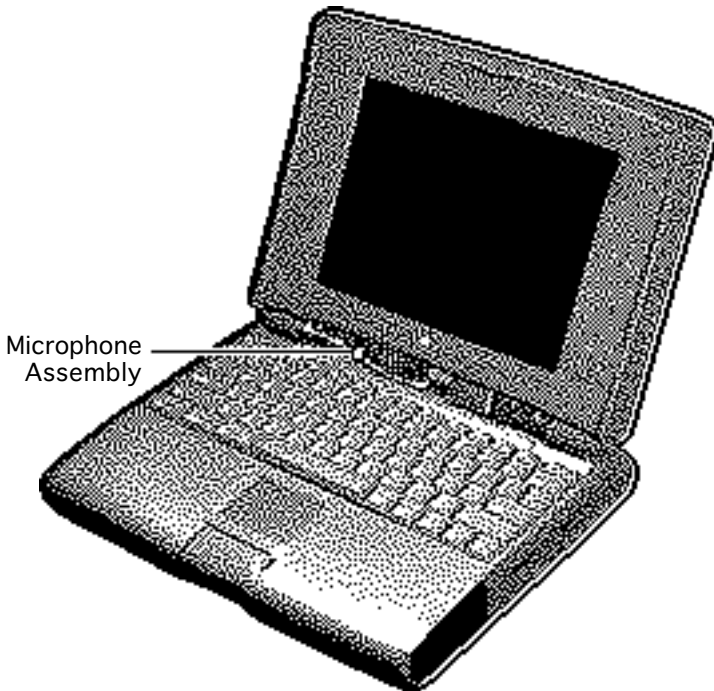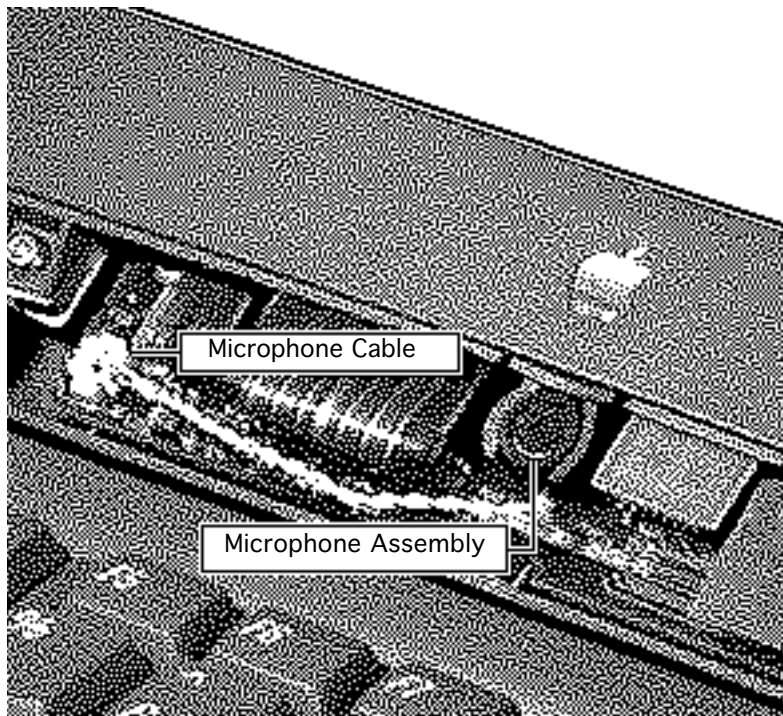
1. Carefully disconnect the microphone cable from the interconnect board.

2. Using a small flat-blade screwdriver, pry up and remove the microphone assembly.
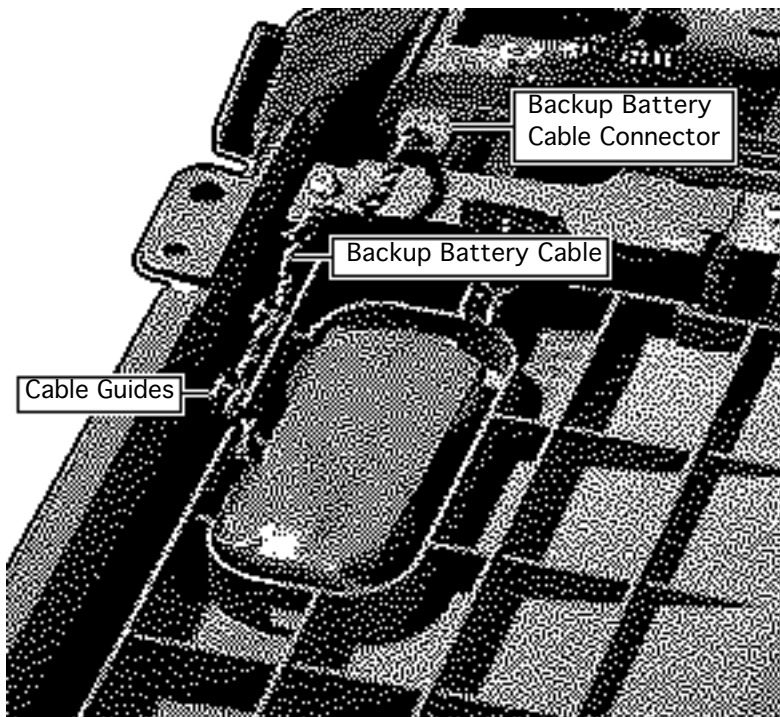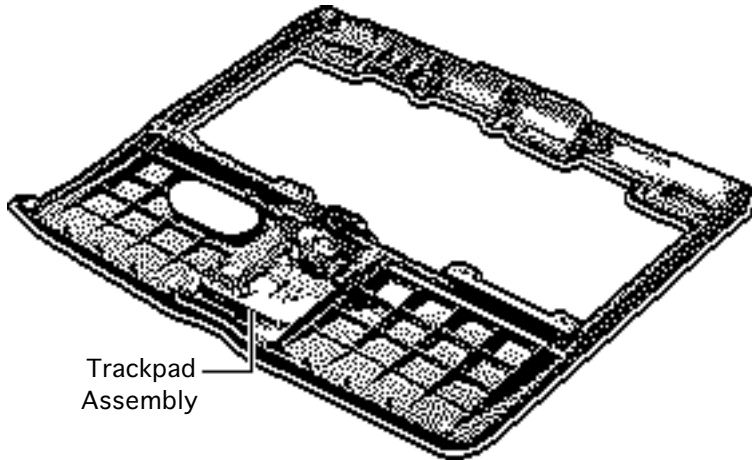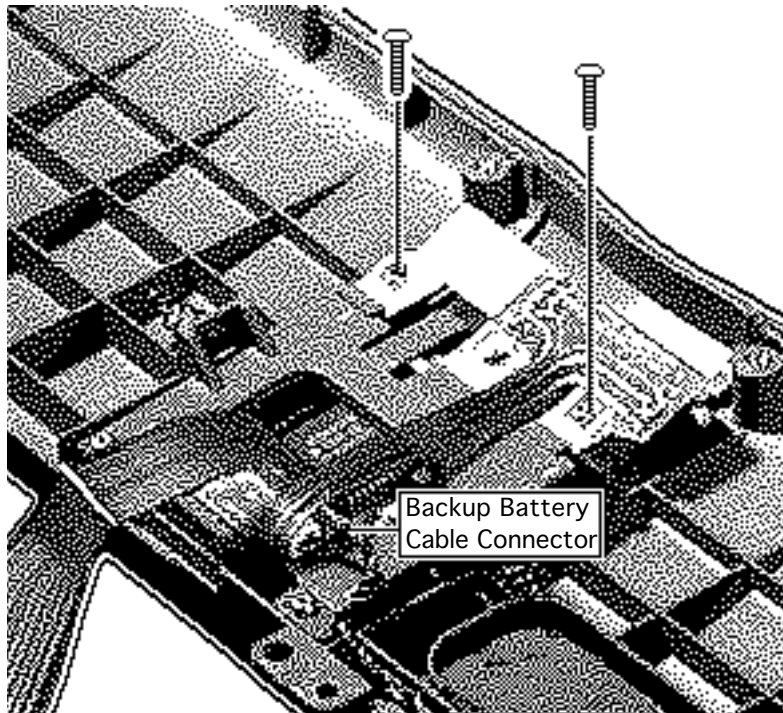
Backup Battery

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive
- Top case

Backup Battery

Backup Battery Cover

1 Using a small flat-blade screwdriver, pry up and remove the backup battery cover.
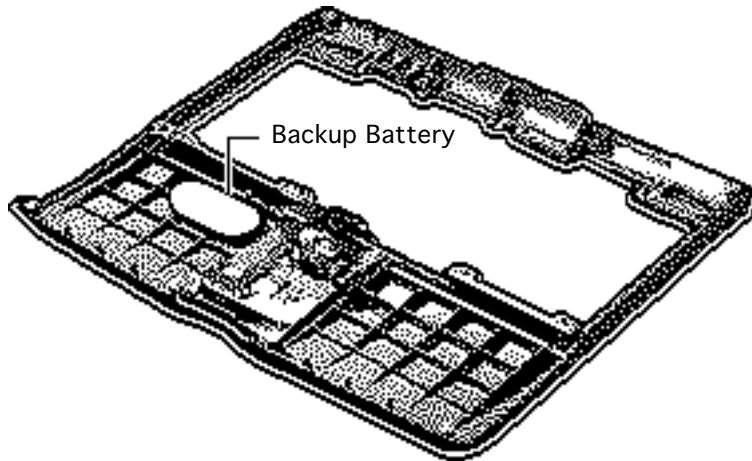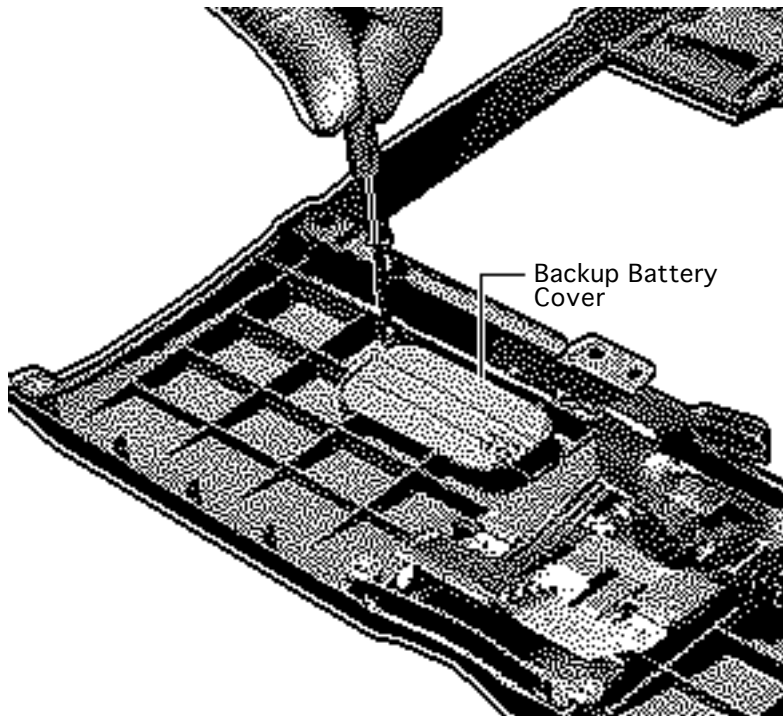
Backup Battery
Cable Connector

Backup Battery Cable

Cable Guides

2 Carefully disconnect the backup battery cable.

3 Remove the cable from the cable guides.

4 Pry up and remove the backup battery and cable.

Trackpad Assembly

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive
- Top case

Trackpad Assembly

Backup Battery
Cable Connector

1 Disconnect the backup
   battery cable.

2 Using a T-8 torx driver,
   remove the front two
   mounting screws.

Trackpad Cable Assembly

Trackpad Cable Assembly Connector
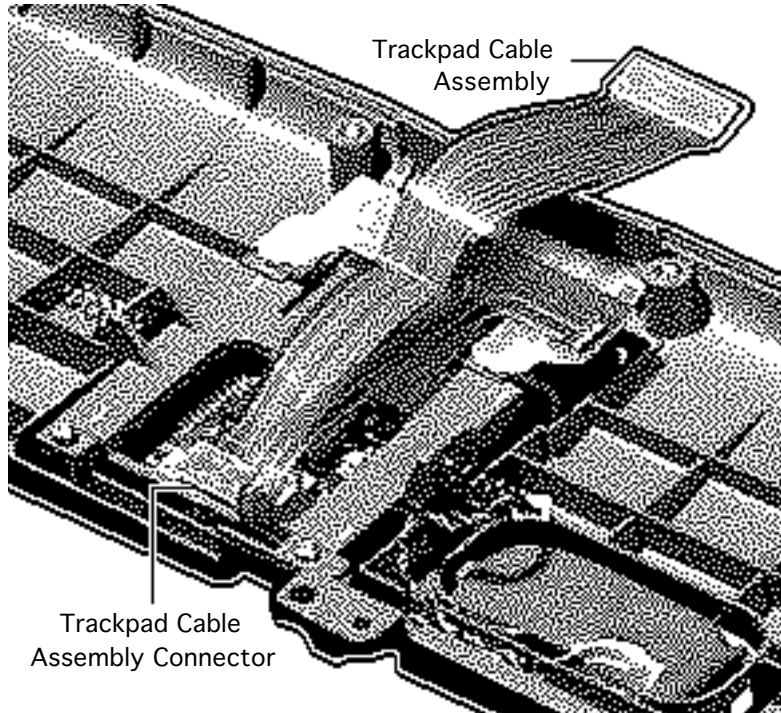
3 **Note:** The trackpad cable assembly includes the display actuator switch and the trackpad button.

Disconnect the trackpad cable assembly and remove it from the unit.

Replacement Note: Reconnect the backup battery cable before reconnecting the trackpad cable assembly.
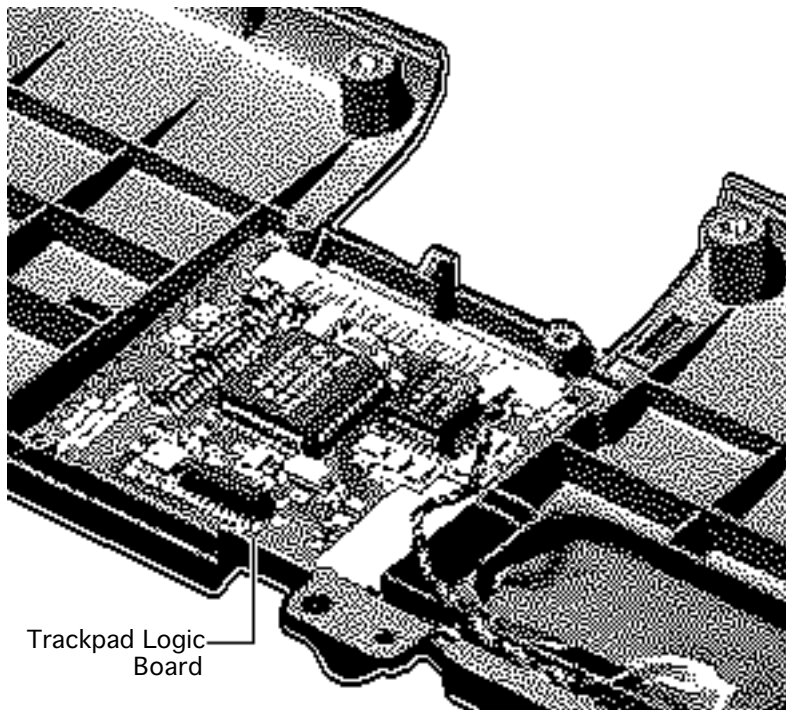
Replacement Note: Before securing the two screws, make sure the flex cable routes on top of the assembly.

Trackpad Actuator Assembly
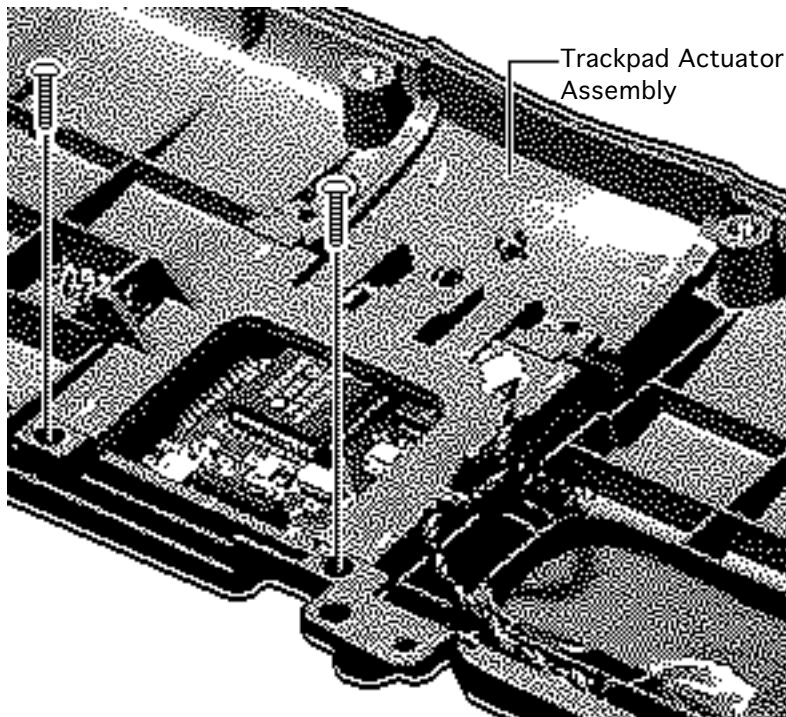
4 Using a T-8 torx driver, remove the remaining two mounting screws.

5 Pry up and remove the trackpad actuator assembly.

Trackpad Logic Board

6   With your fingers, push up from underneath the trackpad logic board and remove it from the top case.
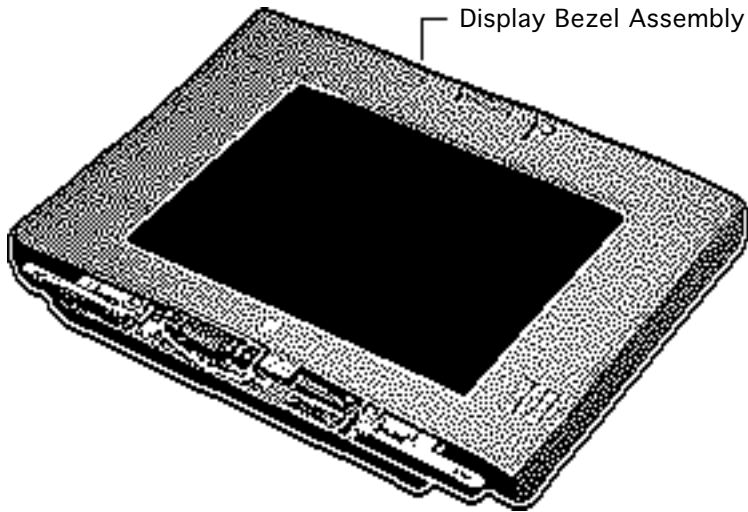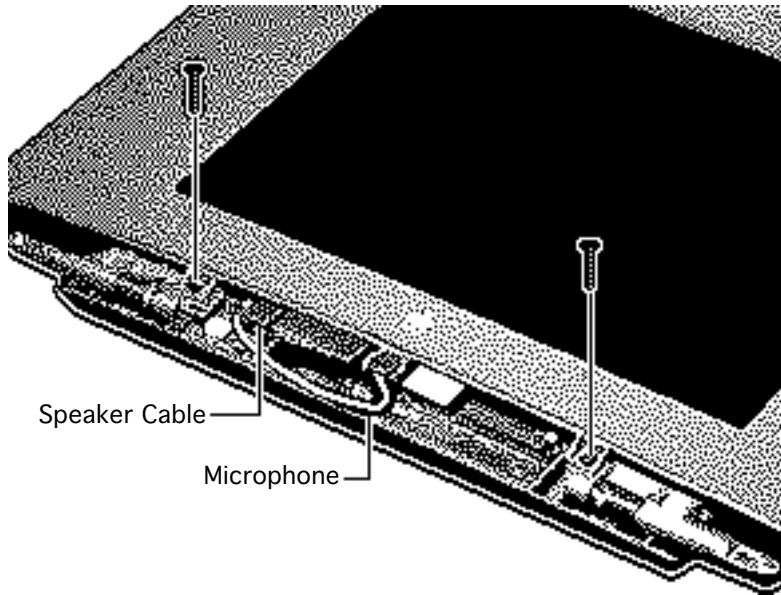
Display Bezel Assembly

Display Bezel Assembly

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly

Speaker Cable

Microphone

1. Remove the microphone from the plastic retainer.

2. Disconnect the speaker cable from the interconnect board.
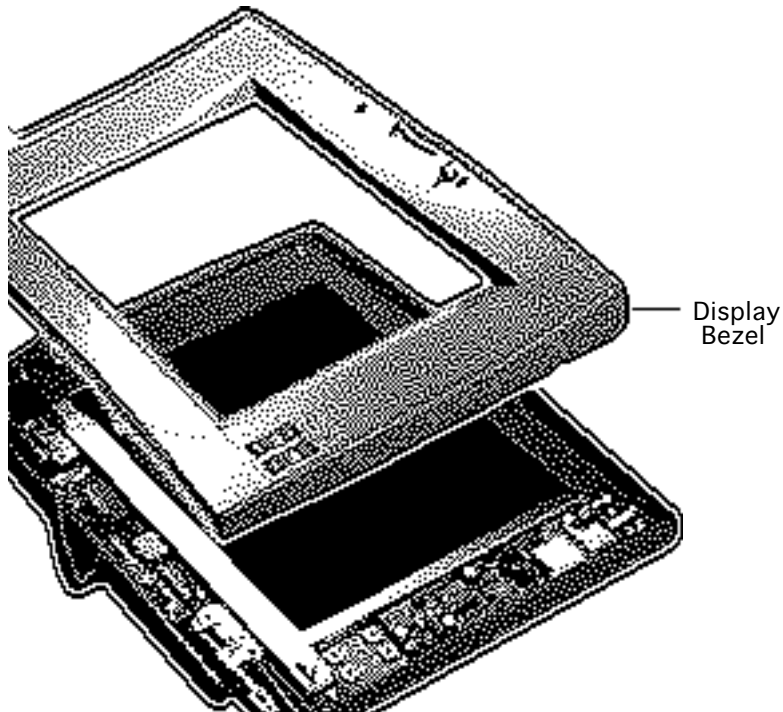
3. Remove the bottom two bezel mounting screws.
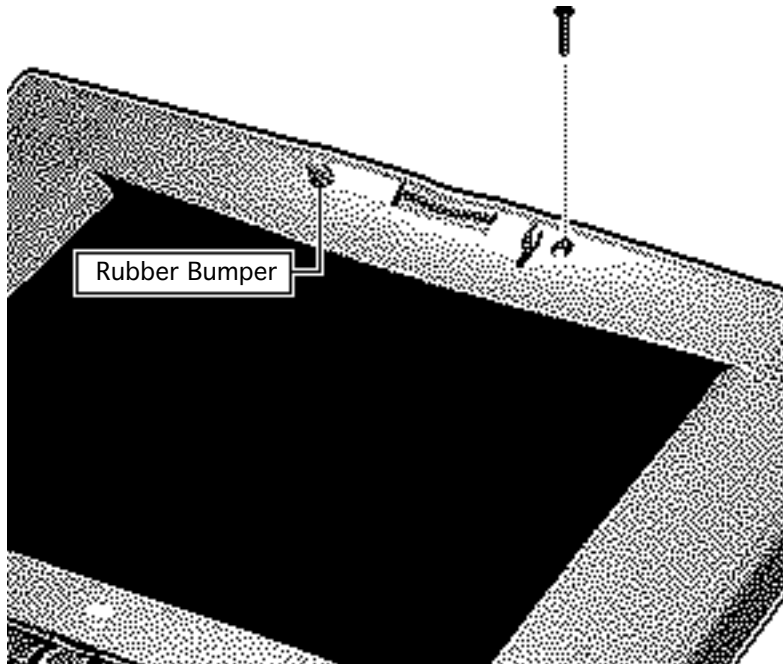
Rubber Bumper

4 Pry off the two rubber bumpers.

5 Remove the top two bezel mounting screws.

Display
Bezel

6 **Note:** Two hooks on each
side of the bezel secure
it to the rear housing.

Pull the display bezel
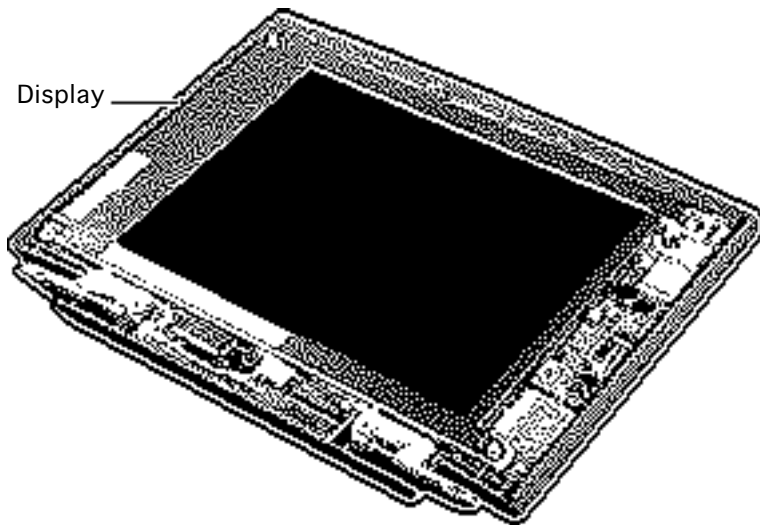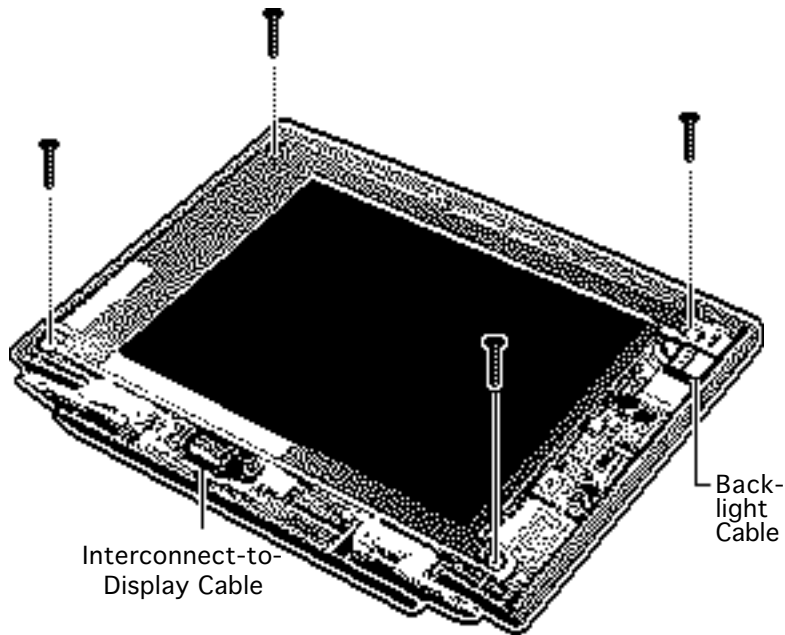forward and lift it off the
rear housing.

Display

Display

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
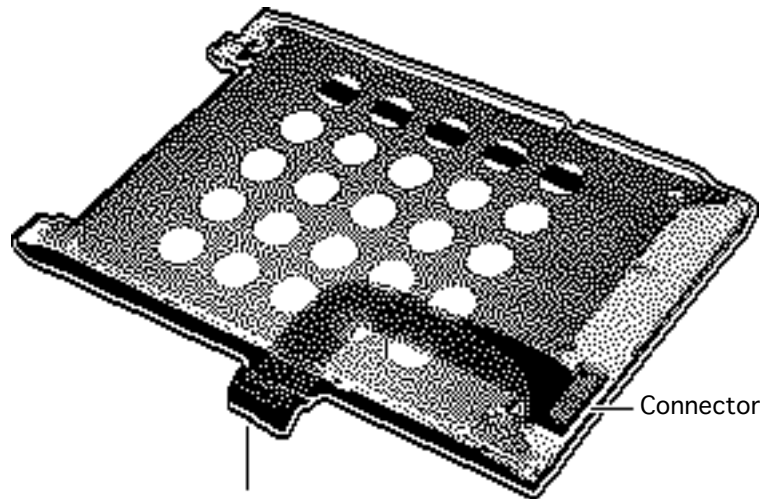- Display assembly
- Display bezel assembly

Note: The PowerBook 540 and 540c display modules are available only to international and CPRC service providers.

Interconnect-to-
Display Cable

Back-
light
Cable

1 Remove the four
  mounting screws.

2 Disconnect the backlight
  cable from the inverter
  board.

3 Disconnect the
  interconnect-to-
  display cable from the
  interconnect board.

4 Lift the display from the
  rear housing.

Connector

Interconnect-to-Display Cable

5 **Note:** Return the PowerBook 540c display with the interconnect-to-display cable attached. Return the PowerBook 520, 520c, and 540 without the cable.

If you are replacing the PowerBook 520, 520c, or 540 display, disconnect and remove the interconnect-to-display cable from the back of the display.
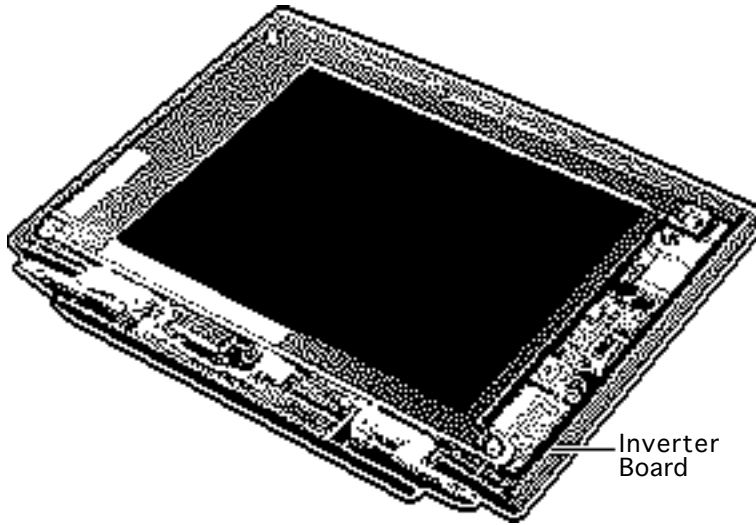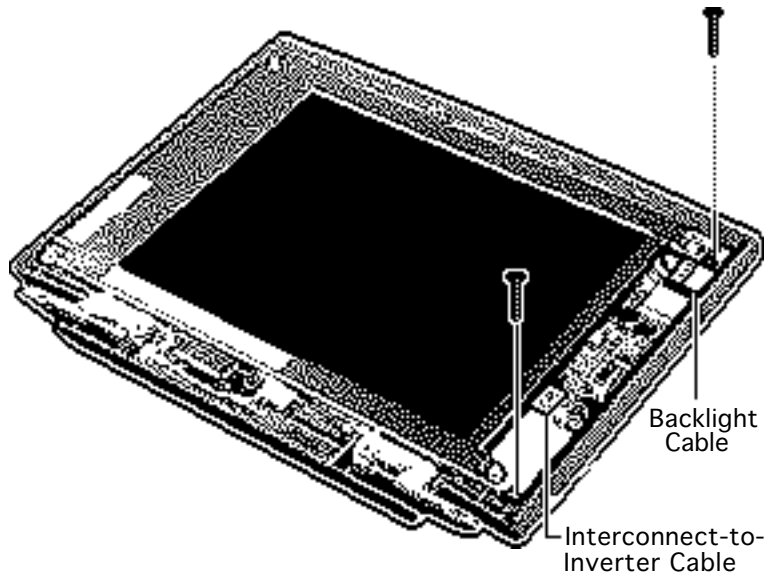
Inverter Board

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Display bezel assembly

Inverter Board

1 Remove the two mounting screws.

2 Disconnect the interconnect-to-inverter cable and the backlight cable.

3 Remove the inverter board.
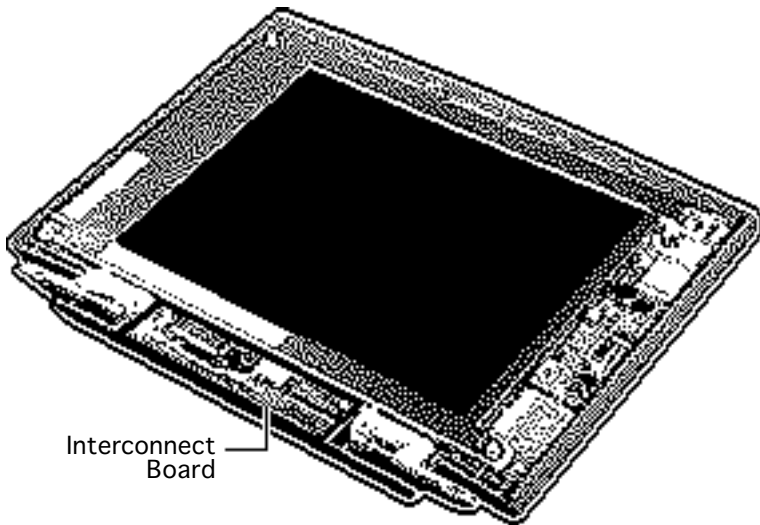
Backlight Cable

Interconnect-to-Inverter Cable

Interconnect Board

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Display bezel assembly

Interconnect Board

Interconnect-
to-Display Cable

Interconnect-to-
Inverter Cable

1 Disconnect the
   interconnect-to-
   display cable and the
   interconnect-to-
   inverter cable.

2 Remove the two
   mounting screws.

3 Remove the interconnect
   board.

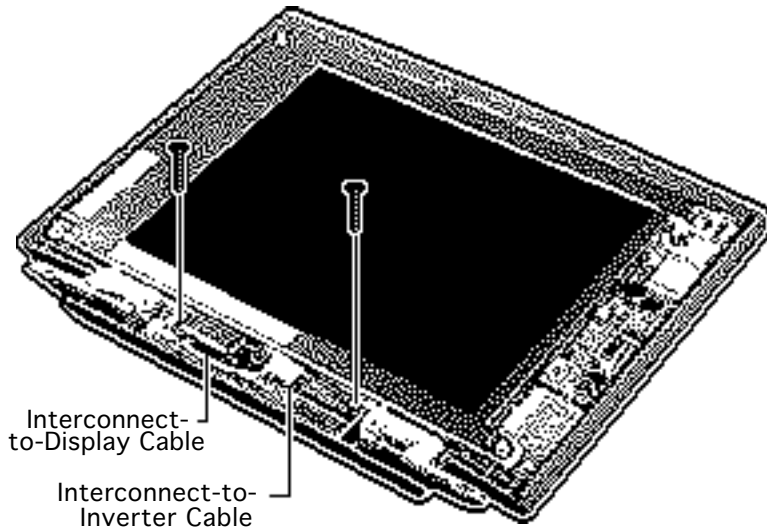Interconnect-to-
Inverter Cable
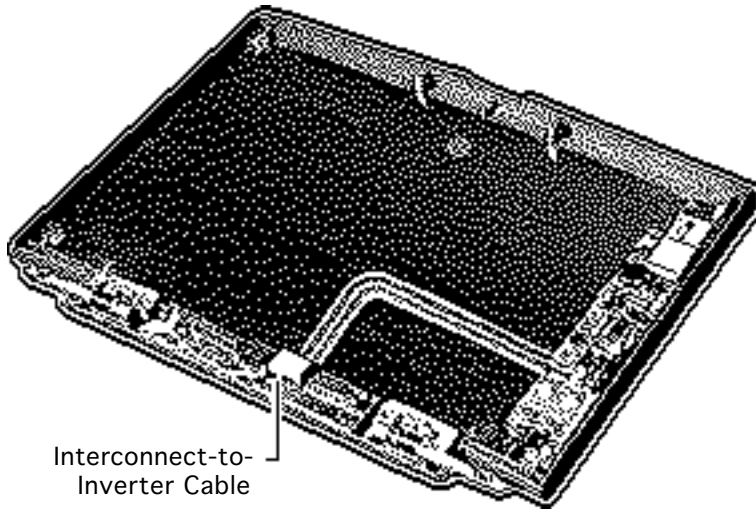
Interconnect-to-Inverter Cable

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Display bezel assembly
- Display

Interconnect-to-
Inverter Cable

Inverter
Board

Interconnect
Board

1 Disconnect the interconnect-to-inverter cable from the interconnect and inverter boards.

2 Remove the cable.

Interconnect-to-Display Cable

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Display bezel assembly
- Display

Interconnect-to-Display Cable

Connector

Interconnect-to-Display Cable

1 Disconnect the
   interconnect-to-
   display cable from the
   back of the display.
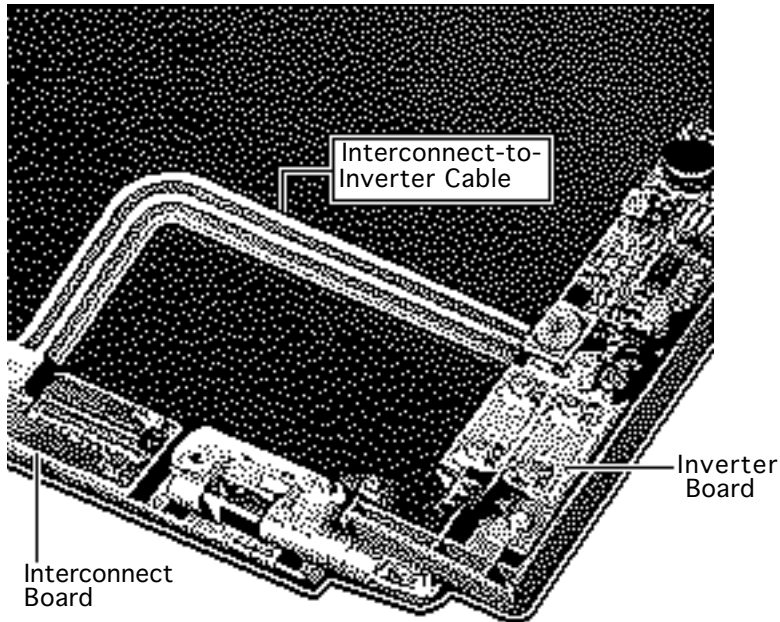
2 Remove the cable.

Clutch

Clutch

Clutches
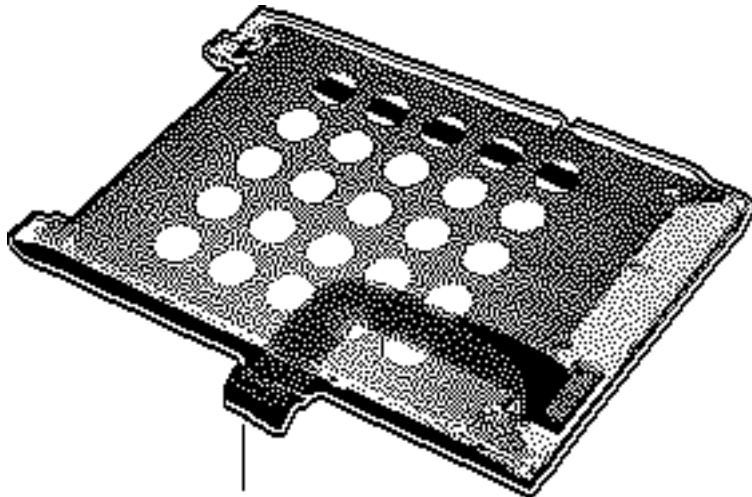
Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Display bezel assembly
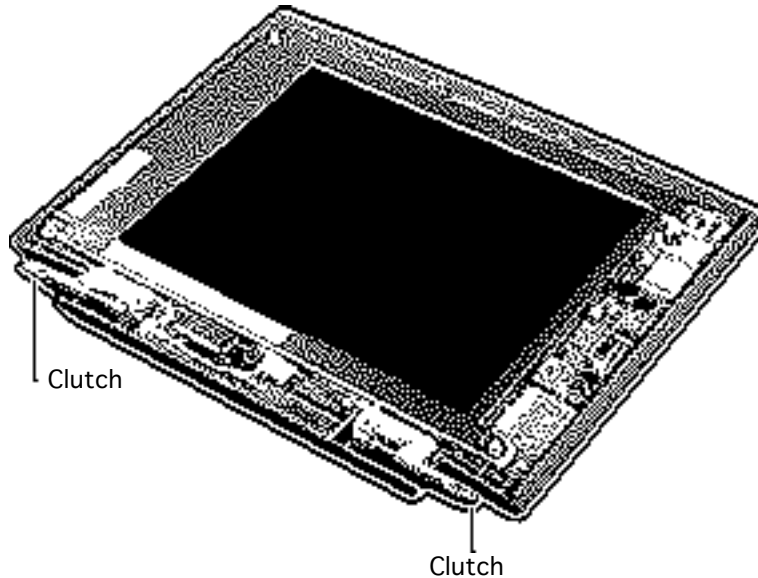
1 Remove the mounting screw for the right clutch and remove the clutch.

2 Repeat for the left clutch.

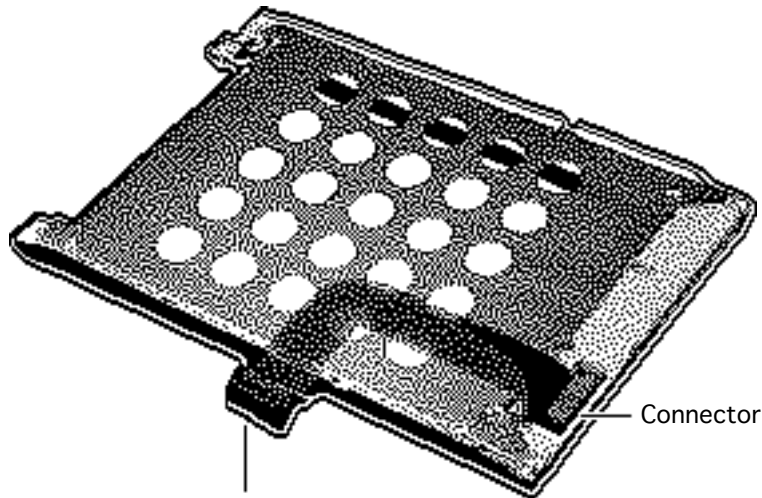Display Rear Housing ⌐

Display Rear Housing

To remove the rear housing, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Display bezel assembly
- Display
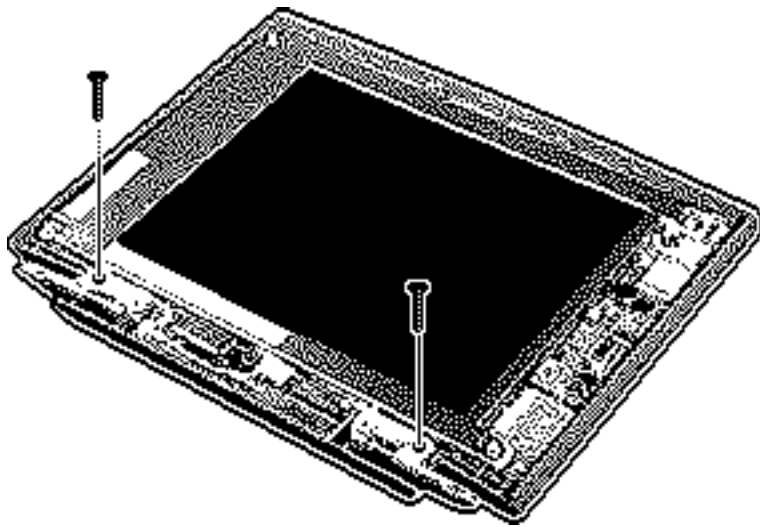- Inverter board
- Interconnect board
- Interconnect-to-
  inverter cable
- Clutches
- Display EMI shield

◀■▶
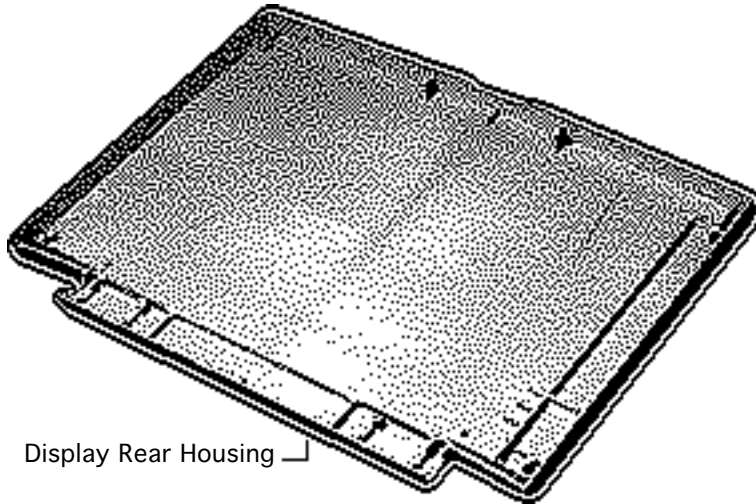
Upgrades

PowerBook 500 Series
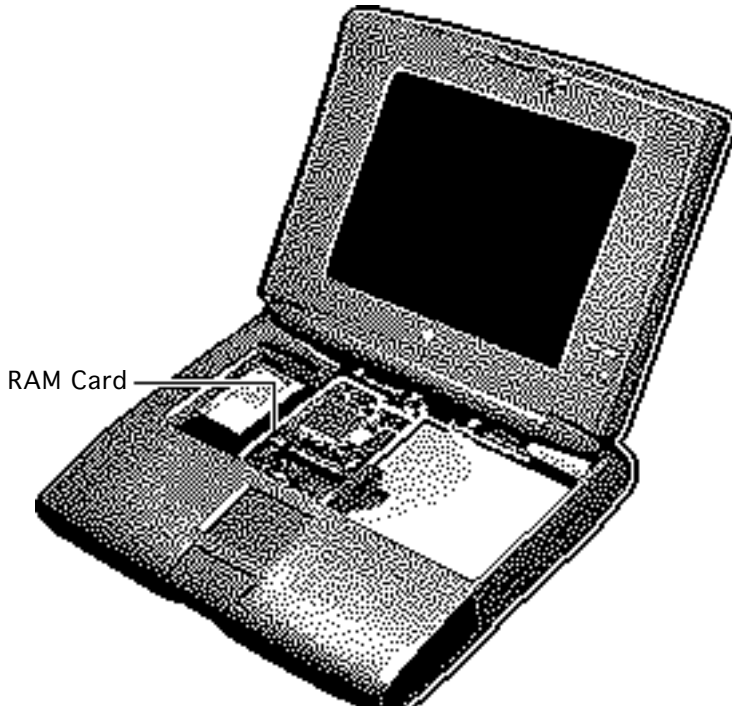
RAM Card

RAM Card

Before you begin, remove the following:

- Battery/PCMCIA module
- Keyboard
- Center base cover
- Daughterboard EMI shield

Caution: Handle the RAM expansion card by the edges only. Do not touch any components on the card.

Note: The RAM card is a PowerBook 500 option. This procedure explains how to install the card.

RAM Card

Expansion Connector

RAM Card Guides
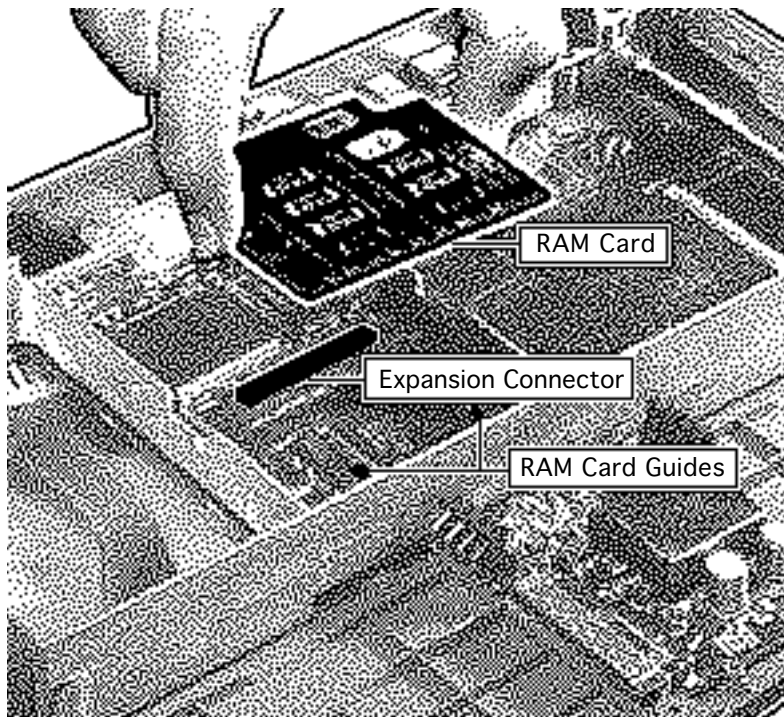
1   Remove the plastic
     retainer bar.

2   **Caution:** An incorrectly
     installed RAM card could
     damage the daughter-
     board. Note that the
     expansion connector and
     the RAM card are keyed
     for proper installation.
     Do not defeat the key by
     forcing the card into the
     connector.

     Caution: When
     installing the card,
     press down on the edge
     directly above the
     connector. Be careful

RAM Card

Expansion Connector
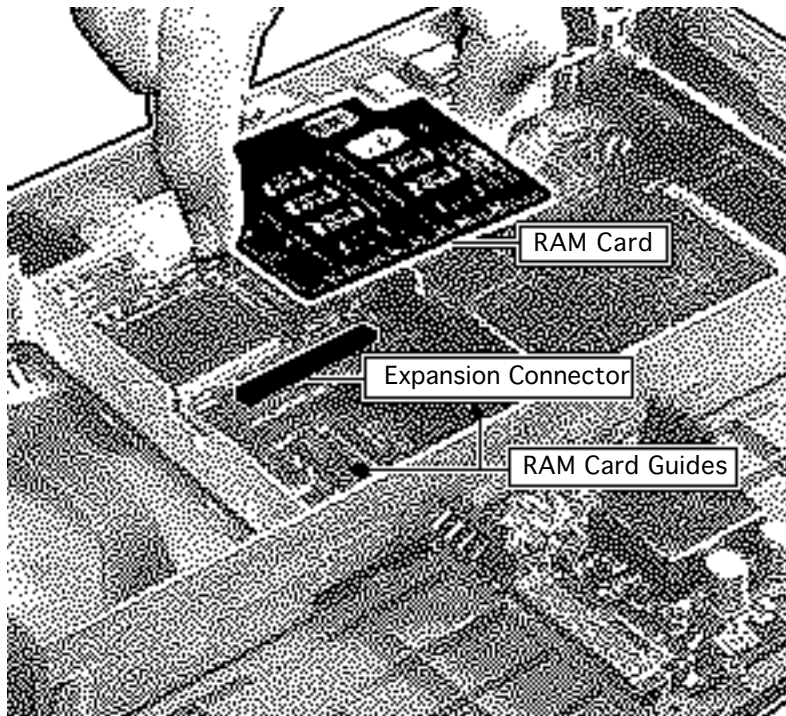
RAM Card Guides

not to apply pressure to any components or you may permanently damage the card.

Place the edge of the RAM card in the two guides. Using the RAM card alignment tool for correct positioning, connect the card to the expansion connector on the daughterboard.

Note: To verify that the upgrade is successful, check the Total Memory message (for systems with virtual memory switched off) or the Built-in Memory message (for systems with virtual memory switched on). The memory size should be 4 MB of soldered RAM plus the RAM on the expansion card. If the memory size is incorrect, replace the expansion card. If the memory size is still incorrect, send the computer to Apple.

Modem and DAA Cards
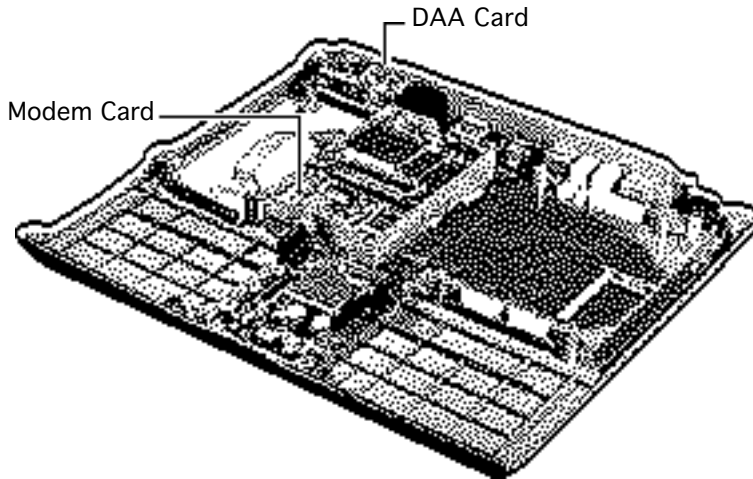
DAA Card

Modem Card

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly
- Keyboard
- Hard drive
- Center base cover
- Floppy drive
- Daughterboard EMI shield
- Top case
- Interconnect-to-logic-board cable

- CPU stiffener
- RAM card (if installed)

Note: The modem is a PowerBook 500 option. This procedure explains how to install the modem and DAA cards and also includes special instructions on how to remove the modem.

Modem Cap
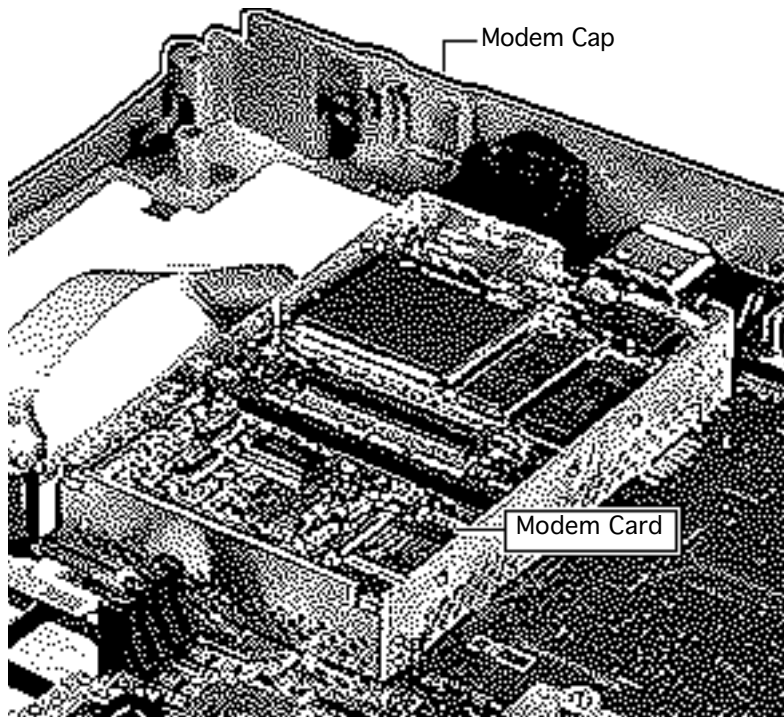
Modem Card

1 Slide the modem card under the RAM card guides and connect the modem card to the motherboard.

2 Pull up and remove the modem cap.

Modem Card with
Modem Port Frame
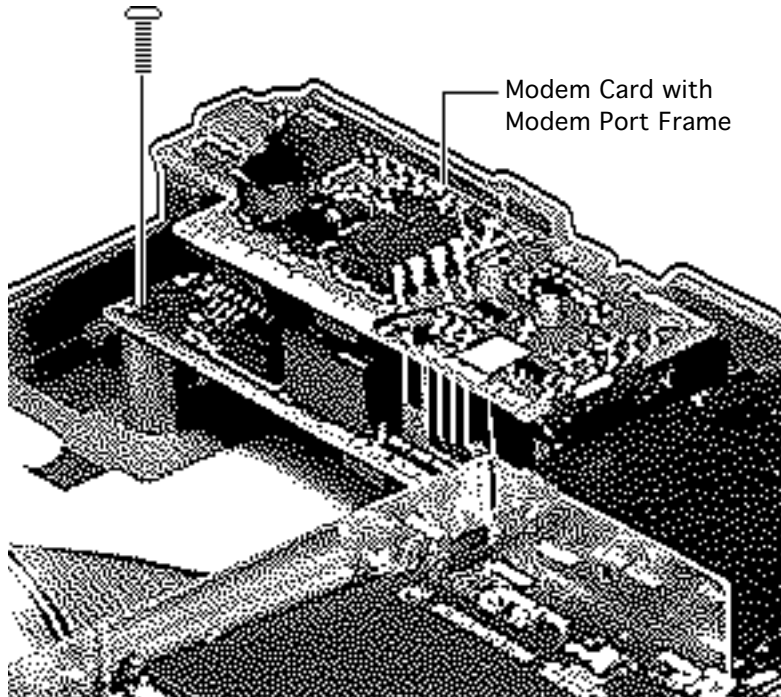
3   Install the modem port
     frame on the DAA card.

4   Note: The connector for
     the DAA card is on the
     underside of the right
     end of the card.

     Connect the DAA card to
     the motherboard.

5   Install the DAA
     mounting screw.
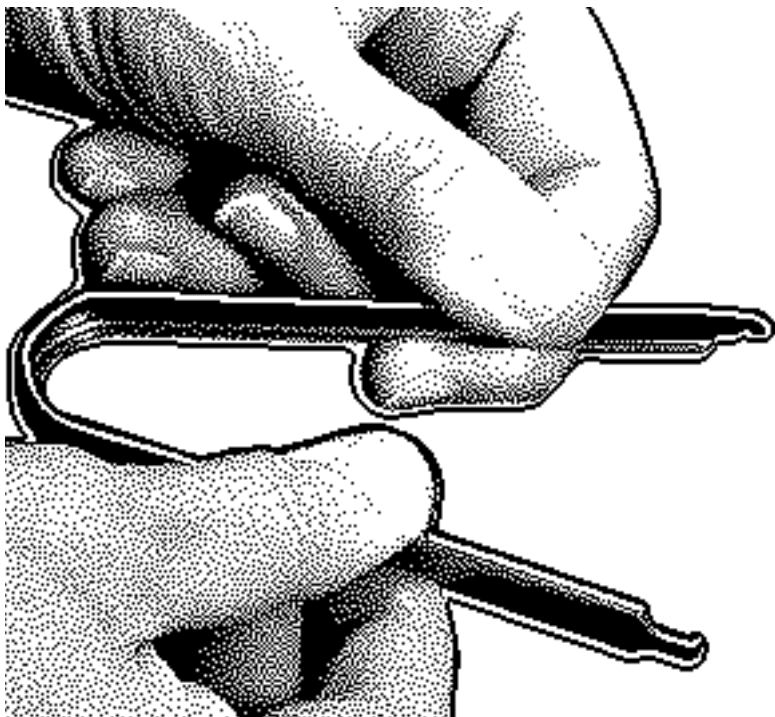
6 **Note:** The following page explains how to remove the modem card. To remove the card, you will need to adapt an IC extractor so that it has a wide grip.

Grasp an IC extractor by the legs and pull outward.
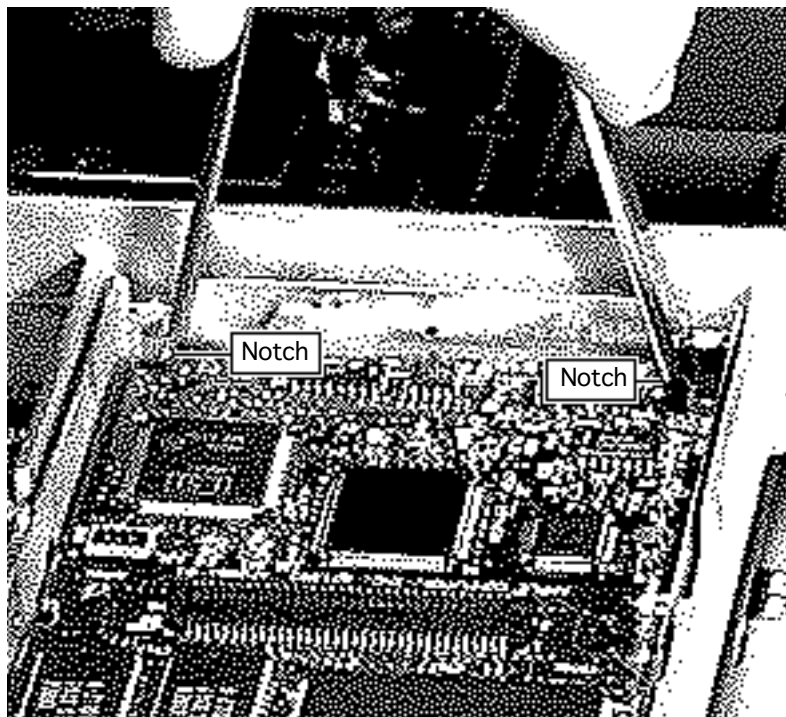
7 To remove the modem card, place the legs of the IC extractor in the notches at the end of the board and pull up.

PCMCIA Expansion Module

PCMCIA Module Upgrade

Before you begin, remove the second (left) battery.

Important: Before removing the battery or inserting the PCMCIA expansion module into the computer, use the Macintosh Shut Down command. Otherwise, the computer will shut down automatically and all RAM contents will be lost.

Note: The PCMCIA expansion module is a

Left Battery Bay
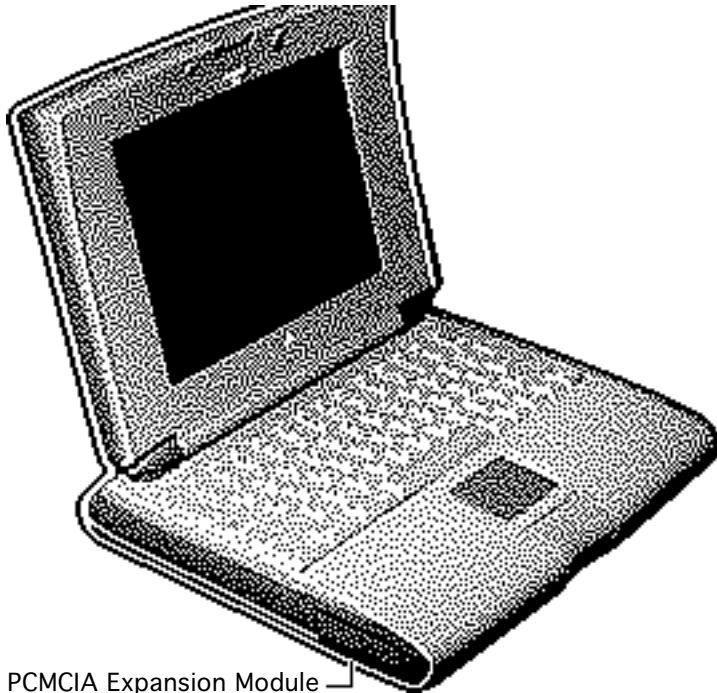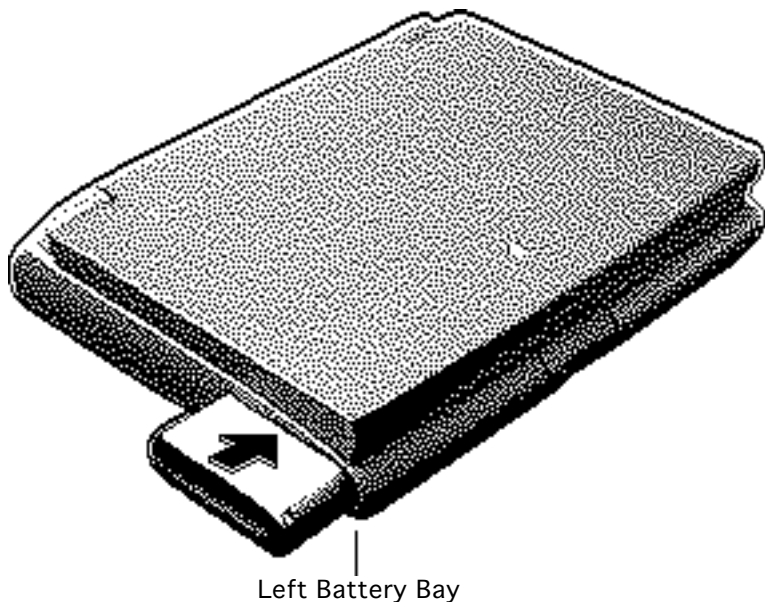
PowerBook 500 option. The module comes with a protective cap and PCMCIA driver software.

1 **Note:** You will feel some resistance when you insert the PCMCIA expansion module into the computer. Continue to press the module in until it is firmly seated.

Insert the PCMCIA expansion module into the left battery bay.

2 **Note:** Refer to the "PCMCIA Expansion Module User's Guide" for directions on how to install the module software.

Install the PCMCIA expansion module software.

Note: Refer to "Battery/ PCMCIA Module" in Take Apart for directions on how to eject the module from the computer.

PB 540c Display

PB 540c Upgrade

Before you begin, remove the following:

- Battery/PCMCIA module
- Clutch covers
- Display access cover
- Display assembly

Note: This information is for reference purposes only; the Finished Goods upgrade is no longer available.
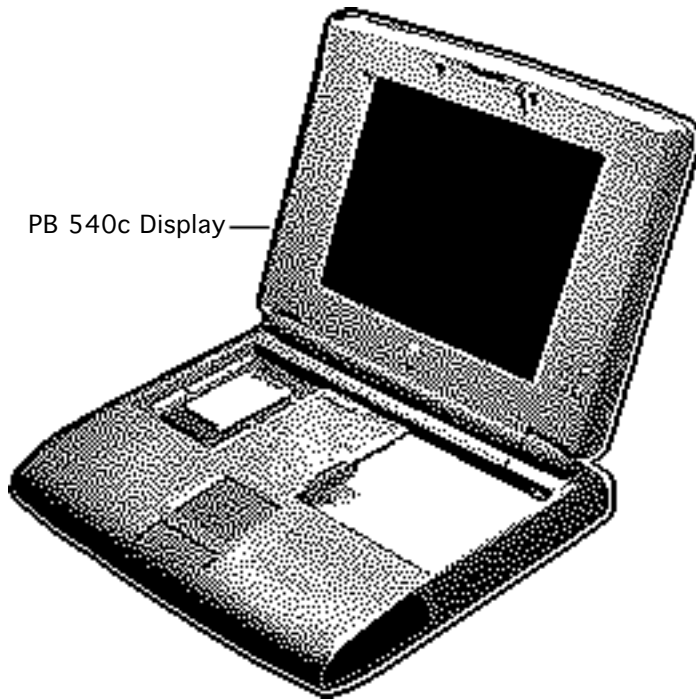
Note: A PowerBook 540c upgrade kit upgrades the display of a PowerBook 520, PowerBook 520c, or PowerBook 540 to a PowerBook 540c display. The upgrade kit consists of a PowerBook 540c display assembly.

Install the PowerBook 540c display assembly. (See "Display Assembly" in the Take Apart chapter.)
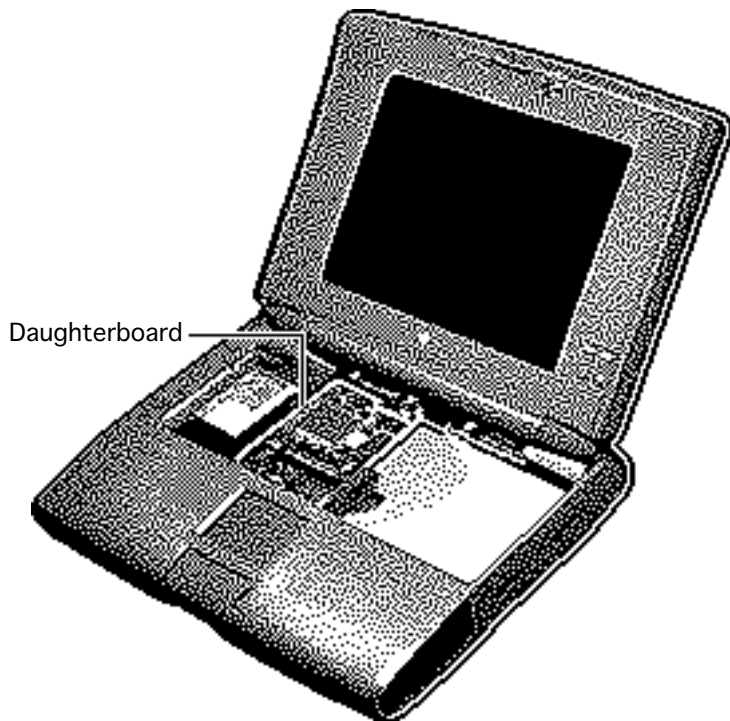
Daughterboard

Macintosh PowerBook Processor Card Upgrade

The Macintosh PowerBook Processor Card Upgrade Kit upgrades the daughterboard of PowerBook 500 Series computers to a 100 MHz PowerPC 603e microprocessor. The upgrade kit consists of the 603e daughterboard and system software 7.5.2 (or later). See the "Daughterboard"

topic in Take Apart for instruction on how to replace the daughterboard. Be sure to install the new software after upgrading the daughterboard.

Note: Rev. A and B versions of the PCMCIA expansion module will not work with an upgraded daughterboard. Customers with these modules must upgrade to Rev. C modules. The update is free to the customer. For more information, see the Repair Extension Program for PCMCIA Expansion Module Update (November 1995 Service Notices).

Note: Currently installed software for Global Village modems will not work with an upgraded daughterboard. Customers with Global Village modems should request updated software directly from Global Village (408-523-1050 or http://www.globalvillage.com).
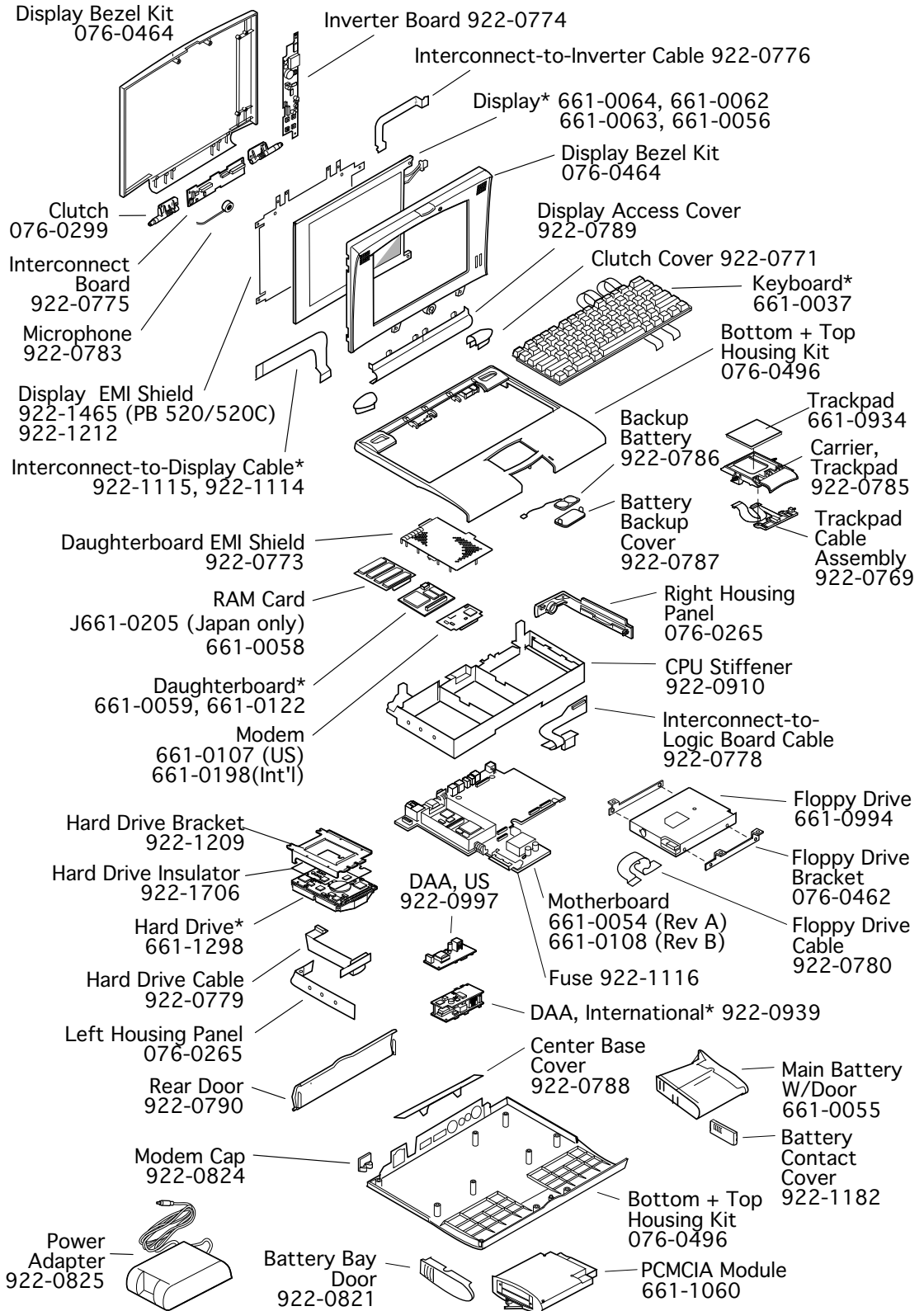
Exploded View

PowerBook 500 Series

Display Bezel Kit 076-0464

Inverter Board 922-0774

Interconnect-to-Inverter Cable 922-0776

Display* 661-0064, 661-0062 661-0063, 661-0056

Display Bezel Kit 076-0464

Clutch 076-0299

Display Access Cover 922-0789

Interconnect Board 922-0775

Clutch Cover 922-0771

Keyboard* 661-0037

Microphone 922-0783

Bottom + Top Housing Kit 076-0496

Display EMI Shield 922-1465 (PB 520/520C) 922-1212

Trackpad 661-0934

Backup Battery 922-0786

Carrier, Trackpad 922-0785

Interconnect-to-Display Cable* 922-1115, 922-1114

Battery Backup Cover 922-0787

Trackpad Cable Assembly 922-0769

Daughterboard EMI Shield 922-0773

Right Housing Panel 076-0265

RAM Card J661-0205 (Japan only) 661-0058

CPU Stiffener 922-0910

Daughterboard* 661-0059, 661-0122

Interconnect-to-Logic Board Cable 922-0778

Modem 661-0107 (US) 661-0198(Int'l)

Floppy Drive 661-0994

Hard Drive Bracket 922-1209

Floppy Drive Bracket 076-0462

Hard Drive Insulator 922-1706

DAA, US 922-0997

Hard Drive* 661-1298

Motherboard 661-0054 (Rev A) 661-0108 (Rev B)

Floppy Drive Cable 922-0780

Hard Drive Cable 922-0779

Fuse 922-1116

Left Housing Panel 076-0265

DAA, International* 922-0939

Rear Door 922-0790

Center Base Cover 922-0788

Main Battery W/Door 661-0055

Modem Cap 922-0824

Battery Contact Cover 922-1182

Power Adapter 922-0825

Battery Bay Door 922-0821

Bottom + Top Housing Kit 076-0496

PCMCIA Module 661-1060

Product family configurations may vary. For parts with astrisk (*), refer to parts list.

PowerBook 500 Series